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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

THE POSSIBILITY OF A CONTRACTING SCIENCE

by

Steven A. Park

December 1986

Thesis Advisor:

David V. Lamm

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The Possibility of a Contracting Science

by

Steven A. Park
Lieutenant Commander, SC, United States Navy
B.A., The Citadel, 1975

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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December 1986

ABSTRACT

This thesis investigates the possibility of the contracting field of study becoming a contracting science.

The paper begins with background material concerning the different problems and difficulties currently encountered in contracting research. A case is made that a more systematic and rigorous (or scientific) approach is needed for gaining insight into contracting phenomena. An examination of the nature, the characteristics, and the requirements of "science" is conducted. Through this examination, the major requirements of; the possession of a distinct subject matter, the description and classification of the subject matter, the identification of underlying uniformities and regularities of the phenomena, and the use of the scientific method were identified. The field of contracting was then evaluated against these requirements. The writer concludes that the field of contracting can and will evolve into a science; however, a change in beliefs and attitudes must first occur.

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LIST OF ABBREVIATIONS

AFBRMC	=	Air Force Business Research Management Center
APRO	=	Army Procurement Research Office
DOD	=	Department of Defense
DSMC	=	Defense Systems Management College
FAI	=	Federal Acquisition Institute
FAR	=	Federal Acquisition Regulations
FPI	=	Federal Procurement Institute

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I. INTRODUCTION

A. PROBLEM STATEMENT

Over the last two or three decades, contracting, as a method of obtaining needed or desired goods and services, has increased significantly both in terms of frequency and in terms of complexity. This growth in contractual actions and costs has placed a heavy emphasis upon the use of procurement research as a means of obtaining a better understanding of the various intricacies and effects of the contracting mechanism. To quote one source, "The increasing frequency and complexity of procurement problems and their associated high costs accentuate the need for systematic procurement research." [1:7] The contracting mechanism as the primary and dominant method of procurement needs to receive some of this increased research attention and effort.

The key to achieving effective contracting research is through the use of a "systematic approach to solving problems, whether known or unknown." [2:2] This systematic approach concept implies that the contracting phenomenon is an orderly, explainable phenomenon and thus has the potential to be studied as a "science". Although the term "science" has different meanings for different people, the concept of "science" implies that a more systematic and

orderly process can be utilized for the development and validation of contracting knowledge. Because more rigor and systematic analysis is needed in the conduct of contracting research, it can be stated that the need exists for the examination of contracting within a "science" context.

B. OBJECTIVES

The purpose of this thesis is to determine if the characteristics and peculiarities of the contracting process lend themselves or conform to the requirements of a science. More specifically, the goal of this paper is to determine if the function of science, which is

. . . to establish general laws covering the behavior of empirical events or objects with which the science in question is concerned and thereby enable the connecting together of knowledge of separately known events, so as to make reliable predictions of events yet unknown. [3:8]

is applicable to the contracting field. Although the whole concept of science and its relevance to contracting will be addressed in this paper, the primary focus will be upon the identification and enumeration of some general contracting principles that have universal acceptance and applicability.

Explicit objectives to be pursued in this study include:

- 1) The determination of the requirements and characteristics of a "science"
- 2) The specification of boundaries pertaining to a contracting science subject matter
- 3) The identification and enumeration of some general principles of contracting

- 4) The examination and evaluation of various difficulties expected to be encountered in attempting to achieve "science" status by the contracting field.

C. RESEARCH QUESTIONS

The following specific questions were addressed during the study.

Primary: Can the field of contracting be established as a science?

- Subsidiary:
- 1) What are the definable characteristics of science?
 - 2) What are some general principles of contracting?
 - 3) Does contracting possess definable characteristics that meet the requirements of a science?
 - 4) How can a contracting science be established?

D. RESEARCH METHODOLOGY

To answer the research questions presented in the previous section, a three part methodological approach was used.

The first part consisted of an extensive review of literature pertaining to procurement research, and science concepts. This literature review was to provide background information on the thesis topic. The Proceedings articles, resulting from the DOD Procurement Symposia conducted over the last fifteen years, were primarily used for this phase.

The second phase involved the selection and examination of disciplines in the social science field that had gone

through or were going through the controversy of science status conferment. The idea behind this approach was to highlight those arguments , both pro and con, that may have specific relevance to the field of contracting. For this phase, the fields of marketing and management were selected and examined for the following two reasons:

- 1) Both marketing and management are concerned with human behavior and its impact upon the efficient operation of their respective fields. This factor is especially applicable to the field of contracting.
- 2) Both marketing and management have had a substantial amount of material written concerning the possibility of those disciplines becoming a science. This bank of literature provides a firm foundation for identifying problems and opportunities regarding the science argument.

The third phase consisted of interviewing selected personnel knowledgeable in the mechanics and characteristics of contracting. The focus of this phase was to identify those contracting principles that, in some form or manner, had general consensus and agreement. The exact wording of the principle was not deemed to be as important as the achievement of general consensus concerning a particular idea or concept of contracting. It was felt that from the information and insight gained from the interviews, some general principles of contracting could be defined. This phase was considered a crucial part of the study as the identification of general principles is considered to be a fundamental requirement of all sciences.

Interviewees were selected based on their familiarity with and exposure to the contracting process and its many peculiarities. In addition, interviewees were selected from the academic and research environment as it was felt that those particular areas were more conducive to the conceptualization and development of general principles.

Appendix A provides a list of the individuals, and their organizations, interviewed for this study. Interviews were conducted during a two week period in August, 1986. The time period for each interview varied from forty five minutes to approximately three hours. Appendix B lists the questions that were used during the course of the interview. Due to the time variation and the rather abstract nature of the answers, not all questions were asked or answered during each interview.

E. LIMITATIONS AND ASSUMPTIONS

Summary of Assumptions

1. A possible bias exists in the selection of material for presentation at the DOD symposia; however, the Proceedings articles reflect current thought on procurement/contracting issues.
2. Contracting is a type of procurement.
3. Personnel knowledgeable in the contracting field are aware of and familiar with certain "guidelines" that can be called "contracting principles."
4. Contracting principles have a basis in underlying uniformities and regularities.

5. The field of contracting is similar to the fields of marketing and management with regards to the control of human behavior.

Summary of Limitations

1. The sample of eleven interviews is not sufficient for obtaining a general consensus on contracting principles, but can provide insight in their nature.
2. The conclusions of this research are limited to the proposed research question.

F. LITERATURE REVIEW

A literature search utilizing the Defense Logistics System Information Exchange (DLSIE) service was performed. The rather abstract and esoteric nature of the thesis topic, however, restricted the usefulness of the DLSIE service. A more creative method of obtaining background information was required.

To acquire a better understanding of the need for and problems associated with procurement research, a review of the Proceedings articles written in conjunction with the annual Department of Defense (DOD) annual procurement research symposia was conducted. This review provided several articles which provided different perspectives on the procurement research issue. The Proceedings articles served as a valuable source of information. Books by Jacques Gansler, The Defense Industry, and Clarence Danhof, Government Contracting and Technological Change, were beneficial in documenting the rapid rise and importance of the contracting method of procurement.

To obtain some insight into science and science characteristics, criteria and requirements, several books on the subject were consulted rather extensively. Of particular importance were: The Structure of Science by T. S. Kuhn, Public Knowledge by J. M. Ziman, What Is Science? by Norman Campbell, The Science Game by Neil Mck. Agnew and Sandra W. Pyke, The Conduct of Science by Michael Friedlander and Marketing Theory: Conceptual Foundation of Research in Marketing by Shelby Hunt. Other books were used to supplement the above mentioned references.

The last phase of the literature review involved the examination of information that discussed the possibility of establishing either a marketing science or management science. Articles providing both pro and con positions were reviewed. Surprisingly, much has been written in this area and locating material was not difficult. Individuals such as Shelby Hunt, Professor of Marketing, Ohio State University; Robert Bartels, Professor, Ohio State University; James Thompson, Professor of the Graduate School of Business and Public Administration, Cornell University; Harold Koontz, Professor Graduate School of Business Administration, University of California, Los Angeles; and Cyril O'Donnel, Professor Graduate School of Business Administration, University of California, Los Angeles have written extensively on the possibility of establishing a science within their related fields.

The Journal of Marketing, the Harvard Business Review, and the Administrative Science Quarterly served as the primary periodical sources for this phase of the thesis. In addition, the books Toward's a Unified Theory of Management by Harold Koontz, Methods of Research in Behavior Science by Thomas C. McCormick and Roy G. Francis, and Management Research by Roger Bennett helped fill in some of the gaps within this area of research.

G. DEFINITIONS

For the purpose of this study, the following definitions will apply:

1. Acquisition: The process used to manage the integration of all activities required to obtain a good or service.
2. Procurement: One of several methods of obtaining goods or services.
3. Contracting: A agreement between two or more competent parties to perform some act for consideration; involves the use of a legal document.

H. ORGANIZATION OF STUDY

This study was initiated to determine if the field of contracting can become a "contracting science." In Chapter II, the increased importance of the contract as a method of acquiring goods and services is documented. In addition, the history of contracting research and the problems encountered in contracting research are reviewed. This chapter is designed to demonstrate the need for viewing the contracting process and contracting research from a

different perspective. In Chapter III, the basic characteristics and requirements of science are briefly examined. Definitions for such concepts as laws, theories and principles are presented and discussed. This chapter provides a general understanding of the science concept. In Chapter IV, major issues regarding the establishment of any human behavior related science are highlighted and addressed. Chapter IV is intended to present those arguments, within a human behavior context, that may have a bearing on the establishment of a contracting science.

Chapter V partially compares the requirements of science to the characteristics of contracting. Three of the four requirements of science, identified during the research work, are addressed within the chapter. Chapter VI discusses the fourth requirement of science; that of underlying uniformities and regularities. The methodology used to identify these underlying uniformities is presented and the results of the identification effort are evaluated and analyzed. A listing of potential contracting principles concludes the chapter.

Chapter VII concentrates on the significance and importance of a field of study becoming a "science." This chapter is designed primarily to answer the question of "So what?" with regards to a contracting science. Finally, in Chapter VIII, the findings are summarized; additional

observations are made, and recommendations for further research are offered.

II. BACKGROUND

A. INTRODUCTION

In this chapter, the growth of the procurement and contracting process is briefly reviewed. Moreover, the relationship between the rapid rise in contractual actions and the need for valid procurement/contracting research will be examined. A review of the current state of procurement research and those factors or constraints that influence the quality of the research product will also be conducted. Although contracting is a type of procurement and is to be considered a subset of procurement; for ease of discussion, the two terms are interchangeable in this chapter.

B. GROWTH AND IMPACT OF CONTRACTING

Transactions involving the use of a contract have always, in some form or another, been an integral part of American society. Whether used to build a ship for a local merchant or to provide supplies to the Continental army, the contract has served as a tool for obtaining desired goods, services, and supplies. What is significant about the contract, however, is that the rapid growth in both the frequency and costs of contractual actions has, within the last several decades, pushed the contract to the front of procurement techniques and methods. Contracting today serves as more than a device to get work performed. Because

of the costs and huge sums of money involved, the contract serves as a major force in American society for the shaping and the executing of company or national policy and strategy. [4:5]

Two major factors have contributed to the growth of the contract. First, American society has and is still in the process of shifting from a goods-producing economy to a service producing economy. Just thirty years ago, service-producing industries claimed about half of all jobs in the economy; today that figure is about 70% of the more than 107 million workers in the United States. [5:38] This growth in service-producing industries has, in turn, had two effects upon contracting. The first effect has been a rapid increase in the number of contracts. Service-related industries are "powerful producers of wealth" and the growth of service jobs is an indication of America's affluence. [5:38] Productivity gains in farming and manufacturing have freed workers to provide services that many poorer societies could not afford--more education, more health, more travel and so on. More service-related industries provide more opportunities for business to contract out services once provided in-house. Consequently more and more contracts are being entered into.

The second major impact of the growth in service-related industries is that the contracts entered into have become more detailed and more complex. Personal labor, skill and

expertise are contracted for rather than specified goods or products. More variables must be identified, negotiated and managed; all of which lead to a more complicated and sophisticated work arrangement.

Another major factor contributing to the growth of the contract has been the maintenance, since World War II, of a high Defense Department and Federal government budget. The post-World War II period has been one of continuous crisis. Conflicts, such as Korea, Viet Nam, Grenada and Lebanon, the Cold War, and the realization that the oceans surrounding the United States no longer provide the physical security desired, have forced a higher expenditure of funds for national defense. Coupled with this reality is the fact that technology, which is progressing at a rapid rate, is expensive and requires Government support. The new technology has created new industries in such areas as computers, jet aircraft, nuclear power and space communications. These industries rely heavily upon government funding for continued operations.

Not only has the Defense Department budget increased, but the entire Federal Government's expenditures are at a much higher level than the pre-World War II period. Government today is expected to "stimulate balanced economic development, curb environmental abuses, promote health, education and scientific progress, assimilate

underprivileged groups into the mainstream of social life and so on." [6:2]

Although different techniques are used to accomplish these various tasks, the contract remains the primary facilitating device. The publication and implementation of the Office of Manpower and Budget (OMB) Circular A-76, which requires the contracting out of those governmental functions most susceptible to efficient commercial performance, has placed additional importance upon the contract as the prime instrument for implementing Government policy. [7:2] The emergence of the "contract state," wherein the authority of the government is shared with private institutions in meeting national goals has altered previously held beliefs and ideas. [6:2] This point was highlighted by Clarence Danhof in his book, Government Contracting and Technological Change, when he stated,

With the evolution of the system (contractual), the government has assumed new responsibilities for decision-making and for evaluating the interests, proposal and quality of work of private organizations by subjective criteria. The changes in role constitute new dimensions in the political process and in the administration of public affairs. [4:13]

As shown, the use of the contract for obtaining goods and services and for directly implementing public policy has grown tremendously since the close of World War II. Although many factors contributed to this growth process, those commented upon in this section are considered the major forces of change.

This rapid growth, however, highlights the urgent need for systematic procurement research so that a better understanding of the peculiarities and ramifications of the contracting mechanism can be obtained. To further quote Danhof,

. . . the evolution of the government contract system has had wide-ranging and disquieting impacts upon the nation's political and economical structures, the ultimate implications of which, in some measure, remain unclear.
[4:13]

Well constructed, properly performed research would provide better visibility and clarification of the contracting and procurement processes. "Front-End" decisions would be made with more intelligent realization of their impact on other factors such as cost, schedule and performance. Many of the pitfalls of the contracting process would be removed through the use of procurement research. [8:6]

C. CURRENT PROCUREMENT RESEARCH

Although the emergence of the "contract state" and the growth in contractual actions has lately placed added importance upon procurement research, interest and concern over the necessity of viable procurement research was expressed some years ago. In 1970, the chairman of the Committee on Government Operations, Chet Holifield, stated that,

. . . procurement research laboratories would identify and exploit new and significant business methods; develop, test and innovate methods on a systematic and centralized

basis, test or simulate the impact of major new policies and procedures on government activities and industry prior to their issuance and provide in-house consulting and training capability to hasten the exploitation of significant developments. [9:112]

The creation of the Army Procurement Research Office (APRO) in 1970, the curriculum expansion of the Naval Postgraduate School to include procurement research capability in 1971, and the establishment of the Air Force Business Research Management Center (AFBRMC) in 1973 were a follow-up by the Armed Services to the procurement research concept. [9:113] Although industry and academia expressed an interest in the idea of procurement research, it was primarily the Department of Defense who pursued such research on any measurable scale. The sheer magnitude of the Government procurement function served as a strong incentive for "the work of refining and improving management and performance of the process." [10:437]

The Federal Government became more involved in procurement research when, in 1975, it created the Office of Federal Procurement Policy (OFPP). In an effort to satisfy one of OFPP's six charter tasks of ". . . promoting and conducting research in procurement policies," [11:23] Mr. Hugh Witt, the Administrator of OFPP, established the Federal Procurement Institute (FPI) (later named the Federal Acquisition Institute (FAI)) on 14 July 1979. According to the Federal Procurement Institute Plan, the FPI, among other things, is :

. . . committed to the objective of developing the skills, knowledge, and abilities of federal personnel engaged in procurement, production, system acquisition, and grants management through the establishment and operation of progressive programs in procurement research. [11:23]

With so many different activities and organizations committed to procurement research, it would be reasonable to assume that a large body of knowledge, rigorously tested and analyzed, along with detailed procedures for conducting research would have been developed. Unfortunately this is not the case. Dr. Robert Williams of the APRO portrayed the state of procurement research as being characterized by anecdote and opinion instead of rigorous analysis, by advocacy in lieu of objectivity, by products based on personal essay and exposition, and by isolated collections of work on related topics instead of an integrated body of knowledge. [12:27]

D. RESEARCH PROBLEMS

To fully understand why procurement research is not as credible or believable as desired, it is necessary to examine some of the underlying constraints or considerations which influence procurement research. This section will identify some of these restraints.

One of the major problems with procurement research today is that there is no general agreement as to what exactly constitutes procurement research. One definition proposed by Heur, Kingston, and Williams states,

Procurement research (and acquisition research) is an applied science using the characteristics of the social sciences in combination with mathematical sciences to solve procurement problems. It tends to rely heavily on the use of previously gathered data to seek solutions to problems, equally dividing its efforts between the acquisition process and the procurement process. In the acquisition process, emphasis is placed on the total process; while in the procurement process, emphasis is on the preaward phase in an effort to identify cost-related problems. [11:109]

Although detailed, this definition states what procurement research is based on what has been accomplished (as published in the Proceedings of the DOD Procurement Symposia). This definition does not indicate what procurement research should be. Many within the procurement field believe procurement research should be long-ranged and of an esoteric nature, while others believe problem-solving, however short-ranged, should be considered procurement research. [2:2] This conflict in definition has created controversy.

Other factors affecting the quality of procurement research lie in the areas of problem identification and research results evaluation. Although many believe that operating management knows which problems need to and can be researched, the fact remains that most problems are not sufficiently defined to permit using research methodologies. [13:16] By not properly articulating and specifying the problem the focus of the research effort is misdirected and the support of upper management is missing. The researcher should be able to translate research results, through

correct problem identification, into useful knowledge "capable of being used at the proper place, time and intensity in management event." [14:11]

Associated with proper problem identification is the fact that researchers do not always focus on "cause and effect" relationships; examining only a narrow segment of the acquisition process in an effort to obtain answers and solutions. By doing this, research may be addressing symptoms of procurement problems, not root causes. [6:4]

Proper evaluation of a research product is a major problem. Even though meaningful and reasonable project performance measures may be determined which will enhance communication and cooperation between the researcher and top management, the greater concern is the correct assessment of the potential value of the research project. Not only must research be evaluated relative to increased performance or cost effectiveness, but it should also be analyzed in the context of "opportunity identification, alternative practices, process extensions and pitfall avoidance." [15:8] Defining success in research is an extremely difficult task to accomplish. The "technological" outcome of research is always easier to identify than the "scientific" outcome, yet, in the long run, the scientific outcome may have more value. [16:5] Since most procurement research conducted today is basically applied research, the technological outcome is more heavily emphasized than the scientific

outcome. Thus, there is generally a short-run orientation to procurement research.

A variation of this problem concerns the "contract state" previously mentioned. The transformation to the contract state and the Federal Government's dependence upon the private sector has brought the realization that the Government has not developed a well-formulated economic theory that can eliminate much of the confrontation between the need for "public accountability" and the need for "private independence." The Government does not have a comprehensive framework of thought for examining these issues. It does not have a systematic method for evaluating the effectiveness of a particular procurement management technique relative to procurement policy or the cumulative impact of many procurement management techniques originating from several different governmental entities. [6:3] Consequently, much research in this area appears fragmented and unstructured.

A major problem facing all procurement research projects today involves the impartiality and objective issue. Most procurement research is supported by a particular organizational sponsor. Because of this, there is a tendency on the part of the organization conducting the research to tailor its results in a fashion favorable to the sponsor. [17] Funding is critical for procurement research. If strings are attached to the funds, either

implicitly or explicitly, then objectivity in research methodology may disappear. [17] This is particularly true of research funded by Government activities involving commercial procurement. Weatherington illustrated this problem when he stated, "In order for the problems of government funding to be properly addressed, an objective review of the concerns of industry management must be addressed." [18:46] Policies implemented based on subjective analysis in research can do incalculable harm both to the procurement process and to the reputation of other procurement researchers.

Another factor mentioned by Judson, which affects procurement research, deals with the lack of a coherent data base of acquisition-related information for use as the essential "tools for research" [19, 6:5]. Failure to have such a coherent data base, in essence, forces the "reinvention of the wheel" for solutions to procurement problems.

These research-related factors have had a significant and, in many ways, a detrimental impact upon the reliability and quality of procurement/contracting research. This is unfortunate, for although some of the factors may be difficult to remedy, all are in fact manageable and solvable. It would appear that improvement is needed if the field of contracting is to obtain respectability and confidence.

E. A CONTRACTING SCIENCE

Standards for expectation of what research should provide have been specified on several occasions. Judson, for one, stated these standards should provide: [20:207]

1. Basis for problem identification and problem solving: the distinguishing of cause and effect relationships.
2. Basis for corporate memory: lessons-learned clearinghouse for maintenance of the database.
3. Basis for developing procedures for new policies: all alternative approaches identified, explored and tested.
4. Independent Research: Long-range, innovative improvements, not constrained by immediate problem-solving.
5. Support of the development of education and training: the determination of which organizations will be concerned with specifying and enforcing standards of conduct.

It can be argued that much of the research conducted today within the contracting field is not meeting any of these standards or expectations. This fact is unfortunate, for faulty research not only harms the contracting process, but it also hampers the efforts of those who are attempting to "professionalize" the field.

Because one of the criteria for recognition of a field as a profession is the establishment and maintenance of a "sophisticated body of knowledge," the contradictory and subjective nature of research products may actually be limiting the sophistication of that body of knowledge. [21:706] Certainly, higher education is a major characteristic of all professionals, yet if the contracting

field cannot obtain a coherent, integrated body of knowledge, then, it would seem that education will be unnecessarily restricted or limited.

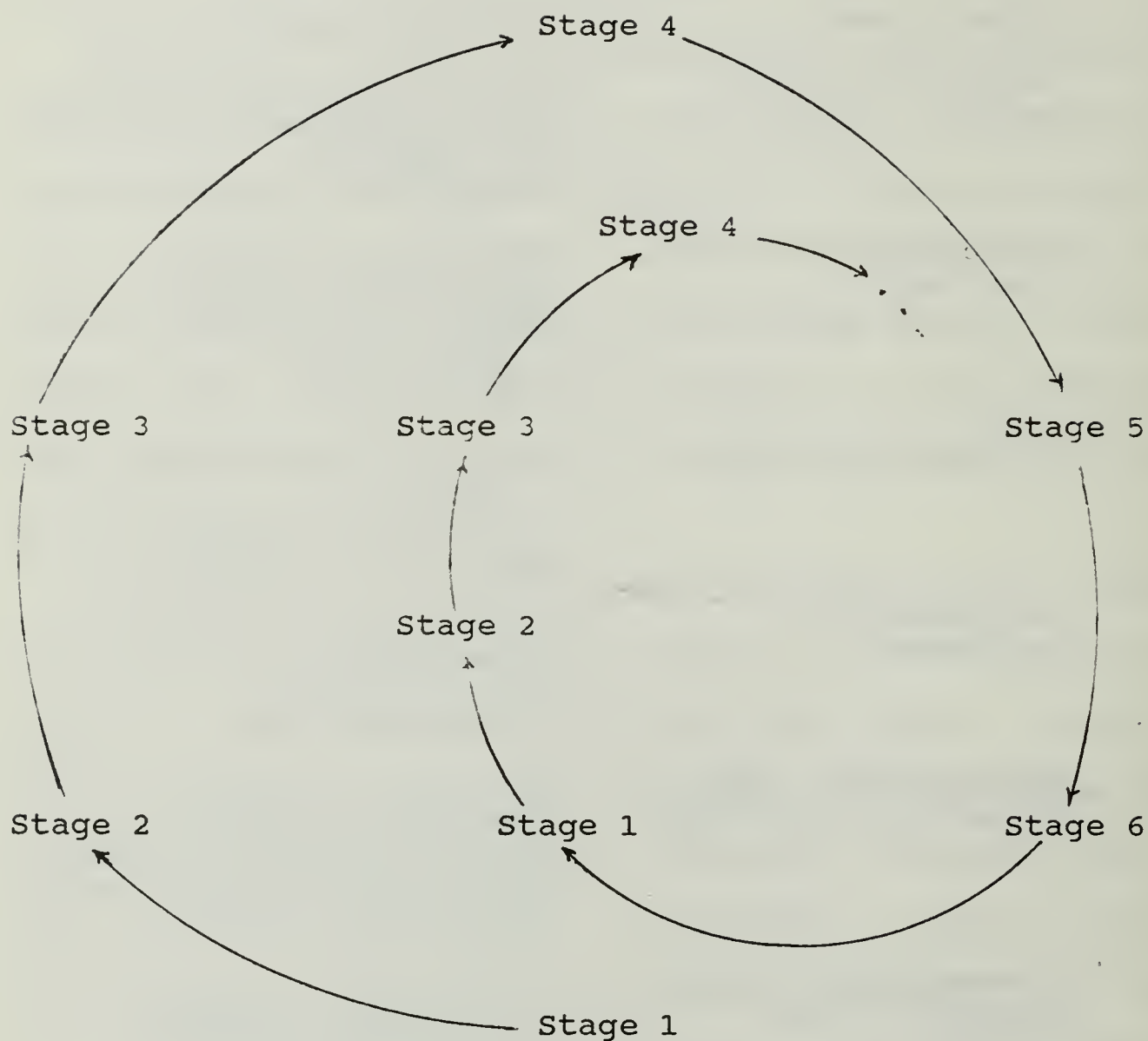
Perhaps it is time to approach both the performance of the contracting process and the conduct of contracting research from a different perspective. The combination of the increased significance of the contracting method, the serious problems pertaining to contracting research, and the strong desire of contracting personnel to professionalize could give impetus to viewing contracting from a science perspective.

The argument for development of a contracting science has been reenforced in another manner. Dr. J. L. Hood of the Defense Systems Management College (DSMC) and Dr. Daniel E. Strayer of the Air Force Business Research Management Center, in their 1973 article, "Sequential Research Needs in the Evolving Discipline of Procurement," articulated six sequential or developmental stages that research transitions in the evolution of a discipline. [22:443] Table 1 presents these different stages along with the organic need and the relevant research conducted within each stage. Figure 2-1 is a graphical representation of the Hood-Strayer Sequential Research Model. Drs. Hood and Strayer felt that research of a particular discipline passed through different stages in terms of refinement and sophistication. The stages, however, were not viewed as linear but spherical

TABLE 1
RESEARCH PROGRESSION STAGES

Stage	Organic Need	Relevant Research
1	Definition of the Field	Survey-Descriptive studies Census Studies Case Reports Demographic Studies
2	Differentiation of the Field	Comparative Studies Exploratory Studies Report of Artistic Experiences Need Analysis
3	Standard Setting	Normative-Descriptive Studies Evaluative Research Instrumental Studies
4	Technological Refinement	Experimental Research Case Studies Theory-building Action-Research
5	Respectability and Dynamics of the Field	Historical Studies Biographical Research Field-Evaluative Studies Survey-Descriptive Studies Comparative Studies
6	Understanding of the Dynamics of the Field	Institutional Studies Environmental Studies Force-Field Analysis Systems-Analysis Prediction Studies

Source: Sequential Research Needs in the Evolving Discipline of Procurement by Joseph L. Hood, Ph.D., Defense Systems Management College and Daniel E. Strayer, Ph.D., Air Force Business Research Management Center



Source: Sequential Research Needs in the
Evolving Discipline of Procurement

Figure 2-1 Research Progression

with research passing through the stages more than once but at a higher plane. Although Hood and Strayer indicated that procurement (contracting) may be entering stage 6 of their model, this researcher would contend that stage 4 may be the more appropriate position. Hypothesis testing, empirical analysis, and theory building characterize this stage and in many respects procurement research is just becoming involved in this type of research and refinement.

Coincidentally, the characteristics of stage four of the Hood-Strayer Model are some of the essential elements of a science. These will be discussed in the next chapter.

F. SUMMARY

Contracting as the most significant means of procuring goods and services has increased rapidly within the last several decades, both in terms of frequency and complexity. Research designed to explain or predict contracting phenomena or behavior has not kept pace with the growing importance of the contract. Several factors and constraints affecting the quality of procurement/contracting research, were identified and explained. The need for valid, objective, and rigorously proven research was discussed. Because of this need and the circumstances and timing involved, the proposition was advanced that contracting should be viewed in the context of a science. Science characteristics, requirements, and concepts will be analyzed in the following chapter.

III. AN OVERVIEW OF SCIENCE

A. INTRODUCTION

To fully evaluate the proposition that contracting can be established and studied as a science, it is first necessary to examine the characteristics and criteria of science. A review of these characteristics and criteria provides the structural and conceptual framework in which contracting will have to be analyzed to determine the possibility of achieving science status for the contracting field. This chapter, therefore, will discuss the various requirements, functions, goals, and aspects of science. Definitions pertaining to science concepts will be discussed and examined. In addition, the importance of scientific laws, the relevance of theory, the evolution of science and the significance of the scientific method and scientific research will be presented. This chapter is intended to serve as a foundation for the concept of a contracting science. Subsequent chapters will build upon the material presented in this chapter.

B. DESCRIPTION OF SCIENCE

Much has been written concerning what is and what is not science. It would be extremely difficult, if not impossible, to state which definition or philosophy of

science is the correct definition. Science has, at various times, been described as: [23:2-4]

1. the mastery of man's environment
2. the study of the material world
3. the experimental method, and
4. the arrival of truth by logical inferences from empirical observations.

Other individuals within the field have suggested that science is the "systematic and controlled extension of common sense." [3:3]

Although these definitions and opinions are all correct to some degree, they do not explain the true purpose or goal of science. These definitions mostly state what science does or attempts to do; they do not really state what science is or what the purpose of science should be.

Norman Campbell, in his book, What Is Science?, may well have best defined science in his statement:

Science is the study of those judgments concerning which universal agreement can be obtained. It is the fact that there are things concerning which universal agreement can be obtained which gives rise to our belief in the external world, and it is the judgments which are universally agreed upon which are held to give us information about the world. [24:27]

This view of science is supported by Ziman through his argument that "the goal of science is to achieve a consensus of rational opinion over the widest possible field." [23:9] Using this definition, science involves the examination of opinions or propositions in an effort to reach general consensus on those opinions or propositions. Science

consists of facts and theories which must survive a period of critical study and testing by capable and disinterested individuals and which are found "so persuasive that they are almost universally accepted." [23:9]

This study and testing by capable and disinterested individuals is a critical aspect of science. Scientific inquiry, with its "continual momentum towards self-correction," guides scientific interpretations of the world towards the trustworthy and reliable; towards the "truth" and towards universal acceptance. [25:35] As can be seen, universal acceptance is a key ingredient of this definition. What is important here is not the hypothesis or propositions which have to be universally accepted, but rather the judgments (laws) which science studies and "on which its final propositions are based that must be universally accepted." [24:30] Differences of opinion occur with regards to the conclusions of the subject matter and not the subject matter itself.

Science has two basic aspects. First, science is a body of knowledge and there is a method for its evolution. In its other form, science is viewed as a pure intellectual study. The proponents of these two forms of pure and practical science are often in opposition to one another. This conflict is analogous to the applied versus basic research debate. Most people today recognize the need for pursuing pure research as a necessity for the development of

practical applications and uses. [24:1] This "necessity" will be important in later discussions concerning pure research as it relates to contracting and the social science.

If science is the striving for general consensus of judgments, what characteristics typify a science? Again, controversy and debate mark this area of inquiry. Hunt has stated the following as "substantive" characteristics differentiating sciences from other disciplines. [26:21]

1. A distinct subject matter
2. The description and classification of the subject matter
3. The presumption of underlying uniformities and regularities concerning the subject matter
4. The adoption of the method of science for studying the subject matter.

Although not all science philosophers agree with these characteristics, there is sufficient general consensus behind these four concepts that they will be used for evaluating whether contracting can be considered a science. These characteristics will be examined within the contracting context in Chapters V and VI.

C. SCIENTIFIC LAWS AND THEORIES

Science is structured by the following: [11:59]

1. Observations (empirical data)
2. Concepts and constructs which are abstractions of phenomenon or other higher level concepts

3. Hypotheses which express possible explanations of cause and effects
4. Principles or laws which consist of hypotheses that have been subjected to some form of experimental verification
5. Theories or derived propositions which relate data, hypotheses and laws in a general and consistent structure

One of the key elements of this structure is the idea of laws or principles. Simply stated, a law is an "assertion of an invariable association." [24:49] Invariable, as used here, implies an unchanging or constant association. Laws are considered the raw material of a science. Not only are complex, sophisticated laws always being built from more elementary and simpler laws, but the elementary, simpler laws are always in the process of being broken down into more basic invariable associations. [24:43-45] Thus, scientific laws are in a constant state of examination and development. Laws order experiences; that is they "change miscellaneous collections of apparently unconnected observations into a connected series of particular instances." [24:68] Laws are needed because they make nature intelligible.

Although the invariable association requirement is the fundamental and primary requirement needed to classify a law, other criteria must also be met. Hunt has stated the following as additional criteria of laws: [26:64-66]

1. Generalized conditionals: If/then relationship
2. Empirical content: Laws must have a basis in factual observations; nonsense statements or strictly analytical statements would not qualify.
3. Nomic Necessity: The implication that the occurrence of some phenomenon must be associated with some other phenomenon; the relationship cannot be just chance (invariable association).
4. Systematically integrated: Laws must not be just a summary statement of observed regularities, but must be able to be assimilated into the larger body of scientific knowledge.

Laws are generally recognized to be of two types: empirical and theoretical. These types are distinguished by the methods by which they are derived. [27:320]

Empirical laws are generalizations derived from an accumulated mass of evidence. Theoretical laws, on the other hand, are

. . . essentially interpretations based upon presupposed notions and not upon tangible measurable evidence Rules of inferences upon the basis of which probability and production are warranted. [27:320]

With theoretical laws, although experience and evidence may not always confirm the stated relationship, the law may be found to be plausible if it is well-phrased. Theoretical laws are identified mostly with the social sciences. [7:320]

Scientific laws can also be classified into various categories in accordance with such factors as time,

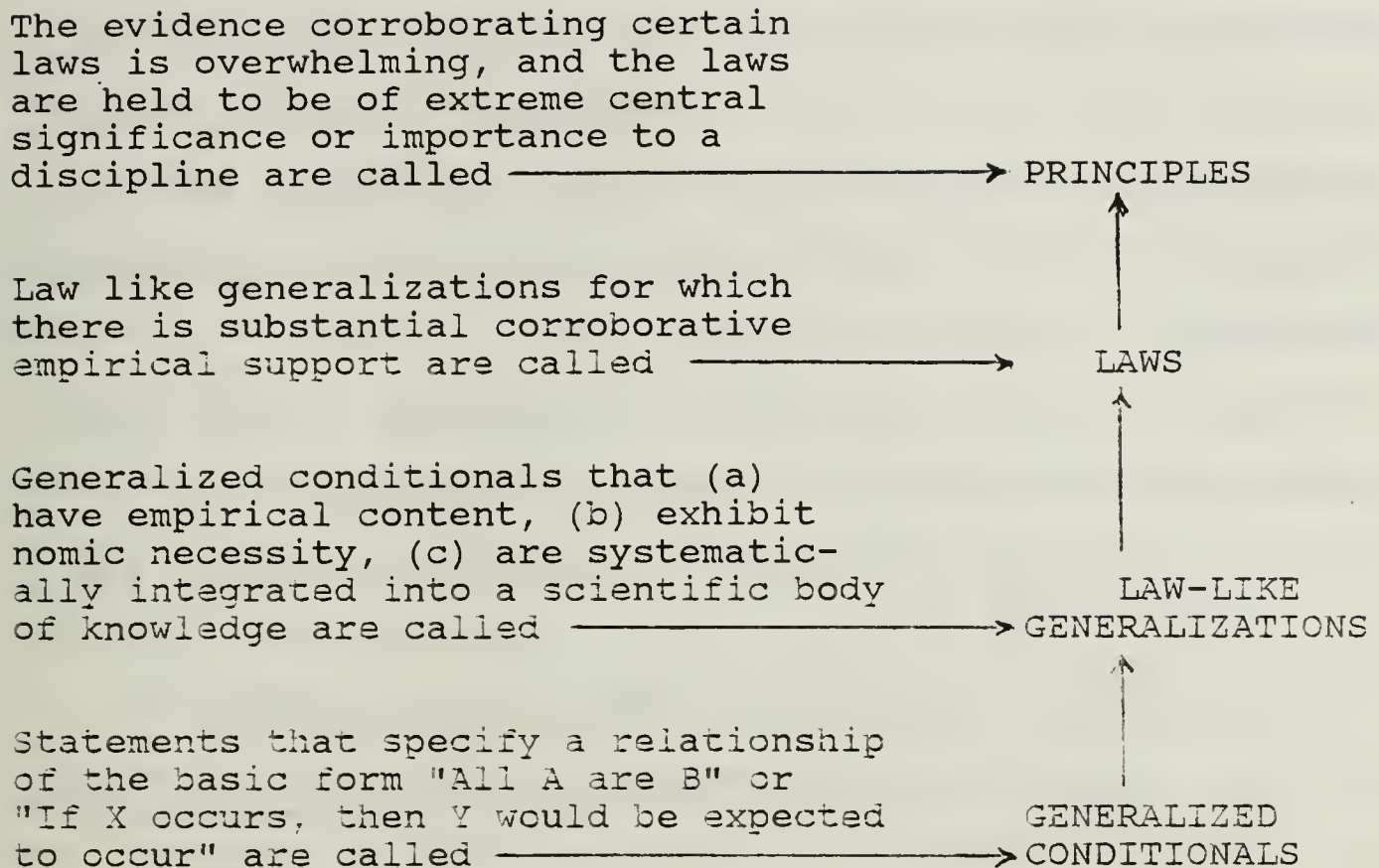
universality and range¹. [26:80-96] A distinction must be made between laws and principles. Whereas laws are "invariable associations," principles are considered to be fundamental truths or fundamental assumptions. They are, in essence, higher order laws in that principles are basically laws that are held to be of "extreme central importance or significance to a discipline." [26:76] In addition, substantial evidence which corroborates the validity and reliability of the principle is available. The hierarchical relationship between principles, laws, law-like generalities, and empirical generalities is illustrated by Figure 3-1.

Just as laws are used to describe invariable associations, theories are used in science as a means of describing or explaining laws. To use a formal definition,

A theory is a systematically related set of statements, including some law-like generalizations, that is empirically testable. The purpose of theory is to increase scientific understanding through a systematized structure capable of both explaining and predicting phenomenon. [26:104]

Three elements are essential to this definition. First is the concept of "systematically related." The statements used to explain phenomena must be incorporated into the total body of scientific knowledge; isolated statements do not contribute to the expansion of scientific understanding.

¹For a complete explanation of the various categories of laws, see Shelby Hunt's Marketing Theory: Conceptual Foundations of Research in Marketing, Chapter 5.



Source: Marketing Theory: Conceptual Foundations of Research in Marketing, by Shelby Hunt

Figure 3-1 Hierarchy of Science

Second, theories must be "empirically testable." This is needed to ensure that different investigators with different attitudes, beliefs and techniques are able to conduct tests and make observations concerning the validity of the theories. Again, since the purpose of theories is to expand scientific knowledge, any theory not empirically testable would not be able to serve this purpose.

Finally, theories must explain and predict. By "specifying what variables are related to what other variables and how they are related, theories enable scientists to predict from certain variables to other variables." [3:9] This predictive quality is considered the greatest value of theories.

From a theory, meeting the definition stated above, three things are possible. These are: [24:89]

1. The laws which the theory is devised to explain are deduced from it
2. The theory can explain those laws in a sense of introducing ideas which are more familiar, and
3. The theory can predict new laws which ultimately turn out to be true.

In short, theory provides a logical ordering or pattern for observation that can be used for simplifying decision-making and for predicting the future. Theory is necessary for any science and the sophistication of theories is a measure of the maturity of a science.

D. EVOLUTION OF SCIENCE

A characteristic that is very central, indeed critical, to any science is the notion of discovery. Discovery, according to Ziman,

. . . is of the utmost importance to science because discovery is the means by which vague, general and untested notions are made explicit and brought into consciousness for acceptance and rejection. [23:20]

The act of "discovering" is necessary for the advancement of a science; new ideas, new theories and new information that

is needed for the clarification and resolution of ambiguities and problems can only be accomplished through individuals "discovering" them.

Thomas S. Kuhn, in his book, The Structure of Scientific Revolution, conceptualizes this notion of discovery, as it applies to science, and places it within a historical perspective. According to Kuhn, a science progresses through phases that are directly related to the obtainment of more sophisticated and cohesive theories and ideas which resulted from scientific inquiry and discovery. [28:10-34]

The first of these phases is basically a "philosophical stage." Nothing is really known about the subject. Much of the information and knowledge is vague, abstract or speculative. The subject appears to be too complex or intangible to allow genuine experimentation and research. Because of this, anyone undertaking study in the area is "often treated with disdain by respectable scholars." [23:51]

The second phase is basically a period of discovery. Through new developments and interests, new observations and discoveries are made. These new observations and/or discoveries not only shed some light upon the subject matter, but they also present new and more demanding challenges for those studying the subject. The vague, abstract generalizations give way to many more contradictory and speculative theories that are tailored to some of the

new developments but are not capable of explaining all of them. More people become interested in the subject and enter the field.

The next phase is the "Epoch of Breakthrough." [23:52] This period is characterized by a general pattern of explanation. Normally, one or a set of related theories, proposed during the previous phase, becomes more refined and polished so that they are better able to explain more of the phenomenon of the subject. These theories or paradigms win acceptance by a larger number of people within the field. The paradigm acceptance permits "selection, evaluation and criticism." [28:17] Achieving a paradigm not only transforms a group of individuals into a profession or (at the least) a discipline, but it also appears to be the major criterion for a field being proclaimed a science. [28:22]

Although great progress is made in the field, there is some conflict and bitterness in this phase, as those individuals who support the disfavored theories are reluctant to give up their interpretations.

The last phase in this model is known as the "classical phase." [23:52] This phase is recognized by the continued refinement of the theories in an effort to fill in any gaps. The new theory hardens into orthodoxy. Normal science research or

. . . research firmly based upon one or more past scientific achievements which the scientific community acknowledges for a time as supplying the foundation for its further practice

is prevalent in this phase. [28:10] Normal science research is directed to the articulation of those phenomenon and theories that the paradigm supplies. The focus of scientific investigation is upon: [28:25-34]

1. The class of facts that the paradigm has shown to be revealing of the nature of things (redetermination)
2. Those facts that can be compared directly with predictions from the paradigm theory (demonstration)
3. The empirical work undertaken to articulate paradigm theory (articulation).

Through normal science investigation, anomalies may be discovered, that, if significant, may trigger a "scientific revolution" and the restructuring of a new paradigm. [28:52-65] Table 2 summarizes the characteristics of Kuhn's Paradigm Model.

Central to Kuhn's science evolution model is the concept of paradigms. Kuhn's definition of a paradigm is "that some accepted examples of actual scientific practice--examples which include law, theory, application and instrumentation together--provide models from which spring particular coherent traditions of scientific research." [28:10] In essence, a paradigm constitutes the world view of a scientific community that incorporates a number of specific theories, a set of symbolic generalizations, a set of shared values or criteria for theory appraisal, and exemplars or concrete problem solutions known to all members of the community. [29:21-22]

TABLE 2

EVOLUTION OF SCIENCE PHASE

Phase	Title	Characteristics
1	Age of Philosophy	A. Nothing Really Known about Subject B. Vague, Mystical, Conjectural C. General Philosophical Principles Invoked D. Conflicting Schools of Thought E. Abstract Notions F. Serious Study Scorn by "Respectable" Scholars
2	Period of Discovery	A. New Technical Developments Give Rise to Objective/Reputable Observations B. New Thought Provoking Discoveries Made C. Many Contradictory and Speculative Theories Tailored to Fit Some of the Newly Discovered Phenomena D. More Scientists Enter Field
3	Epoch of Break-through	A. A General Pattern of Explanation Emerges Which Gains Wide Acceptance B. Adoption of a Paradigm C. Great Progress Made in Field D. Some Bitterness and Conflict Between Old Guard and/or Disgruntled Rivals and New Accepted General Explanation Advocates
4	Classical Phase	A. Refinement of Paradigm B. Normal Science Research C. Hardening of New Theory, New Pattern of Thought into Orthodoxy D. New Orthodoxy Becomes Conventional Wisdom Which Must be Broken Through for Next Major Advancement

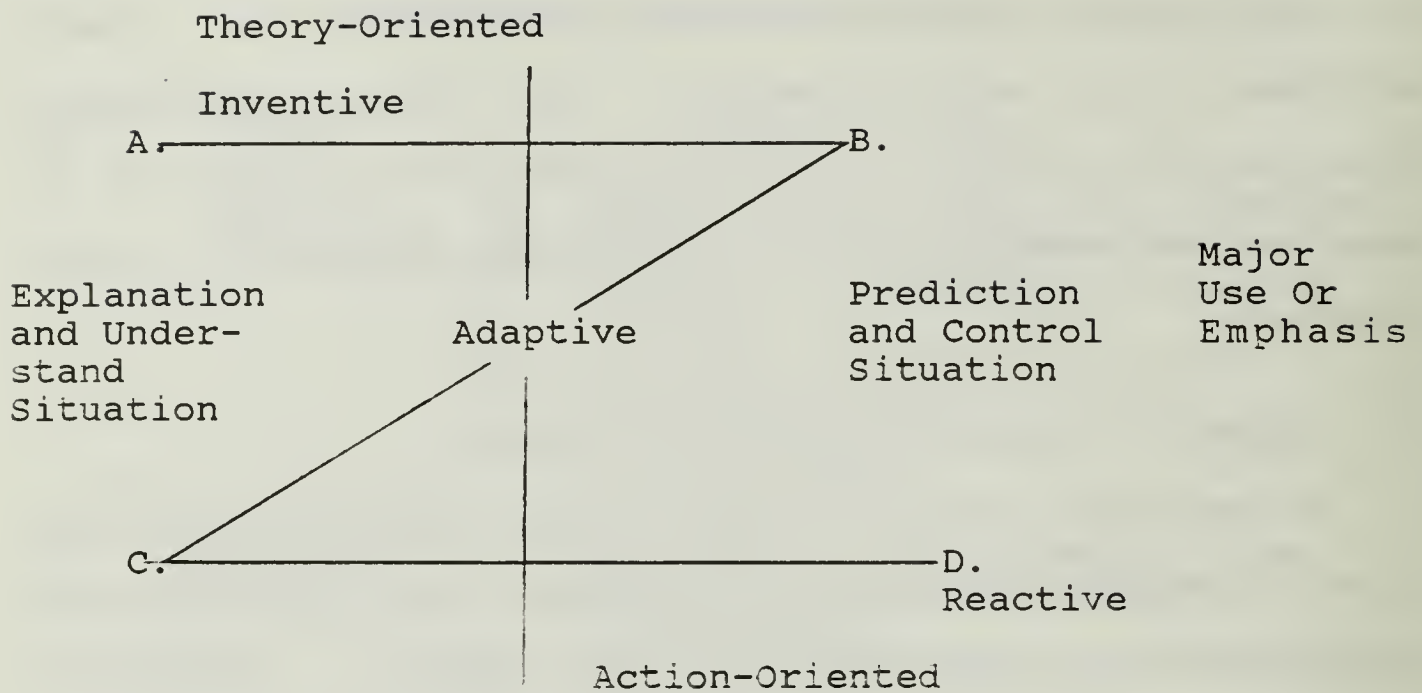
Source: Developed by researcher through interpretation of The Structure of Scientific Revolutions by Thomas S. Kuhn and Public Knowledge by J. M. Ziman

Although several philosophers of science have criticized the Kuhn model on several points, the pattern of events outlined by his model appears to have general agreement. This pattern of events in the evolution of a science will be examined in relation to a contracting science in later chapters.

E. SCIENTIFIC RESEARCH/SCIENTIFIC METHOD

As mentioned earlier in this study, discovery resulting from scientific research is necessary for the continued expansion and advancement of any science. Scientific research has been described as "a systematic, careful inquiry or examination to discover new information or relationships and to expand/verify knowledge for some purpose." [30:24]

Although research efforts are geared primarily towards the generation of new knowledge and ideas, some types of research seek to apply or use existing knowledge and ideas for resolving current problems and questions. [30:143] Research then, can be considered as existing on a continuum--a continuum that ranges from theory-oriented to action-oriented. [30:39] Figure 3-2 illustrates this continuum.



Source: Management Research by Roger Bennet

Figure 3-2 Types of Research

The vertical axis in the illustration represents the two extremes or levels of the research continuum (theory vs. action), while the horizontal axis reflects their main use or emphasis. Lying on this continuum, Bennett has identified five different types of research that can be classified in one of three categories as follows: inventive, (A-B in Figure 3-2; represents the producing of new ideas, theories and testing validity), adaptive, (B-C, the translating of ideas into working principles), or reactive, (C-D, the developing of an understanding of everyday problems and the controlling/predicting of their results)

[30:38] These five types of research and a brief description of each are as follows: [30:34-35]

Pure basic research--research that is concerned with resolving, illuminating or exemplifying a theoretical issue. It's aim is to promote knowledge and understanding of the world.

Basic objective research--research that examines a general problem of the application of knowledge, but does not seek to solve a particular practical problem; still general in nature.

Evaluation research--research concerned with the assessment of some aspect of the performance of an enterprise; basically involves the analysis of the effectiveness of program changes.

Applied research--research aimed at solving a specific practical problem within an organization.

Action research--form of research where action is both an outcome of the research and a part of the research process; main purpose is to improve the base of knowledge for the sponsoring activity.

As these types of research lie on a continuum, there is overlap and encroachment among the different types.

In addition to these five types of research, different levels of research are also possible. Because different disciplines or areas of study have different states of knowledge, different methods of research are used to examine the different disciplines. Particular methods are more relevant to one level than another. The four levels of research, which are not mutually exclusive, which have been identified are: [30:83]

Description--describing what exists; considered most basic level of research

Classification--observational research identifying similarities and differences in what has been studied

Explanation--Seeking an understanding of what is happening; representing this understanding in theoretical models and propositions

Prediction--forecasting outcomes by using established theories and formulas.

Description and classification levels of research are used to establish a basis for building theories. Theory building, as stated previously, is critical for the development and maturation of a science.

Research methods can vary from historical research to surveys, interviews, observations and experiments. Crucial to whatever method of research utilized, however, is the concept of "rigor." The term rigor in this particular instance refers to the "extent to which the method employed strictly adheres to the fundamental requirements of research design." (30:83) Bennett states that these levels of rigor are classified as first, second, and third levels. [30:84-85]

First level rigor consists of those methods which offer a qualitative and narrative approach to the analysis of variables. This level involves minimum scope for the classification of the variables studied. [29:84] In the second level of rigor, quantitative measurement becomes important. The emphasis shifts from illustrating or describing variables to that of measuring and changing variables. This rigor level allows for the identification

of variable relationships, but not necessarily the determination of causal relationships. [30:85] The third level is concerned with manipulating variables to determine the causal relationships. This level normally involves experimentation, usually in the laboratory or the field.

[30:85] According to Bennett,

Research should be at the highest level of rigor appropriate to the objects and needs of research itself. . . . Information derived from first and second level rigor methods is important to the development of theory. [30:85]

Although research can include unscientific techniques, it is generally recognized that the "usefulness and soundness of any research effort depends on its objectives, its design and the skill and integrity with which it is conducted." [11:48]

Normally, some variation of the scientific method is used for conducting scientific research. This method is well-known and has generally recognized procedures. The primary steps of the scientific method include: [11:49-50]

1. Observation or perception through a searching process
2. Definition of the research problem
3. Formulation of the research plan
4. Gathering data/facts and testing the hypothesis or evaluating the relationship
5. Formulation of new hypotheses, decision rules, or generalizations in the form of conclusions
6. Documenting the research project.

Associated with any discussion of the scientific method is the issue of positivism versus relativism. Briefly stated, positivism (or empiricism) "usually refers to a type of strict empiricism in which only those knowledge claims that are based directly on experience are considered important, useful, and/or scientifically meaningful."

[31:118] Positivists claim that through formal logical analysis of theories and by means of unbiased observations, "the truth of any proposition can be determined absolutely" [31:118]

Relativism (or constructionism), on the other hand, "conceive of many possible realities, each of which is relative to a specific context or frame of reference."

[31:120] According to relativists, "scientists construct 'realities' by developing a degree of social agreement about the meaning of their theories and empirical observations." [31:120]

This positivism/relativism argument is a crucial factor in the formulation of scientific theories and the utilization of the scientific method; more so in the study of social sciences where so many more variables are involved. Relativism implies that "there are few truly universal standards of scientific adequacy." [29:25] Consequently, as Anderson has indicated,

. . . research programs become "encapsulated" and are immunized against attack from the outside. Within a program, knowledge is sanctioned by consensus . . .

theories are justified to the extent they conform to programmatic commitments. [29:25]

This topic will be addressed further in the next chapter during the discussion of marketing/management principles and theories.

Although all types of research at various levels and at different rigor levels are necessary for the building of a knowledge base, it is interesting to note that scientists are influenced by a set of values with regard to scientific research preferences. Weinberg summarized these values as follows: [32:98]

1. Pure research is better than applied research.
2. General research is better than particular research.
3. Search is better than codification.
4. Paradigm breaking is better than spectroscopy.
(confirmation of accepted laws and the accumulation of more data is not as useful in the extension of knowledge as in the breaking of paradigms, which presumably leads to broader generalization)

Two things are evident from Weinberg's work. First, scientists seem to place a higher value on pure or inventive research. Second, the importance of normal science research, articulated by Kuhn and mentioned in the last section, is supported by item number four.

Research results may be used to generate new ideas and concepts, to test and develop new applications and to promote or demonstrate better practices and techniques. [30:145] For these "uses" of research to occur, however, it is essential that research results be properly disseminated

to applicable practitioners, consultants, and other researchers. On the surface, research dissemination would appear to be a relatively easy process. This, however, is not always the case. Many obstacles, such as poor communications, mistrust, lack of funds, lack of time and inappropriate dissemination mechanisms often prevent the smooth and timely reporting of research results. [30:145-148] As the intellectual exchange and discussion of new ideas and concepts is the lifeblood of any and every science, failure to adequately and accurately disseminate research findings can have an adverse affect upon the progress of scientific knowledge. Great care must be taken to ensure that research is not only conducted properly, but that the results of research are properly distributed.

F. CLASSIFICATION OF SCIENCE

Science is subdivided or classified in terms of its component disciplines: [11:60]

1. Abstract science
2. Natural Science
 - a. Physical
 - b. Biological
3. Social Science

Abstract science (i.e.mathematics) is generally "pervasive throughout the methodology and nature of other sciences." [11:60] Natural Science is the "empirical study of actual material events of nature, both physical

processes and things." [11:60] Social science, also known as the behavioral science, is the study of social phenomena and "pertains to how people behave, what is their relationship between human behavior and total environment and why people behave as they do." [33:8]

The researcher would contend that a contracting science, because it "pertains to how people behave," would fall within the category of a social science. Before addressing contracting as a science, it will be helpful to further explore the social science category in an effort to identify and evaluate those peculiarities, problems and issues associated with the category. This exploration, using a marketing/management perspective, will be accomplished in the next chapter.

G. SUMMARY

The purpose of this chapter was to present a basic foundation of critical science concepts and definitions. An understanding of these concepts and definitions is necessary for the adequate evaluation of contracting in terms of science. Ideas and views concerning the goal of science, the function of laws and theories, the evolution of science, the importance of scientific research and the classification of science were presented and commented upon. For ease and convenience, definitions of the key science terms to be used in the remainder of this thesis are contained in Appendix C.

How contracting meets or conforms to the concepts and definitions of science will be the subject of Chapters V and VI. Chapter IV will look at the area of social sciences through the filters of the marketing and management disciplines. Chapter IV is designed to highlight those issues and problems confronting marketing and management in their quest for science status. It is believed that by highlighting the specific marketing/management science problems and issues, those problems and issues expected to be encountered in the evaluation of the contracting science proposition may also be identified.

IV. SOCIAL SCIENCE ISSUES

A. INTRODUCTION

The fields of marketing and management have been embroiled for a number of years in the controversy of whether either of the two disciplines is science. Much has been written, pro and con, which addresses specific issues of the argument. By highlighting these issues and their relevance to the contracting field, a greater insight and understanding of the obstacles and problems which might be encountered in the advancement of the "contracting science" proposition, will be obtained. As discussed in Chapter I, marketing and management were selected for review for two main reasons. First, the explanation, prediction, and control of human behavior, to some degree, is the primary focus of the three disciplines. Second, both marketing and management have recently grappled with the "science" controversy and therefore, an abundance of fairly current information is available. In addition, marketing, as the "process of exchanging goods in the marketplace," [26:5] is closely related to contracting, which can be described as the "process of acquiring goods and services in the marketplace." [17]

This chapter is basically divided into four sections. The first section briefly discusses the evolution of the

marketing/management fields towards the realm of "science." Section Two will identify specific problems confronting or hampering the two fields and, by extension, other behavioral sciences in their quest for "science" status. The third section will discuss the value of studying the fields from a science perspective. Section four is a summary of the chapter. Because the two different fields of marketing and management are reviewed, issues, problems, and arguments presented will be of a generalized nature; that is they apply equally to both marketing and management and, in all likelihood, would also apply to contracting.

B. EVOLUTION

The idea or belief that marketing or management could be a science basically originated in the 20th century; more specifically, in the late 1930's and early 1940's [34:1; 35:2] Just as the field of contracting is discovering today, the then changing conditions of the American economy and society placed added emphasis upon a more systematic study of the problems confronting managers of the two fields so that better, more informed decisions could be made.

As business expanded to include international markets; as organizations changed to meet growing demands and requirements; as the sophistication, cost and rate of introduction of new products increased because of new technology; and as employees and consumers became more educated and knowledgeable, management was confronted with a

host of new problems that required new and better solutions. Bartels identified the circumstances leading to the development of marketing thought as: [36:1]

A. Environmental conditions

1. The expansion of industrial production
2. The creation of new products through new inventions
3. The increase in population, education and personal income
4. The exaltation by social values of financial success

B. Changing perceptions of people regarding the market.
(Increased attention given to the market, institutions, social role and improvements of those in marketing)

These circumstances were also relevant to the development of management thought. Because of new attitudes and developments, the old methods of learning management or marketing skills through "on the job" training or through "hit or miss" techniques were no longer applicable. Decisions involving millions of dollars, affecting hundreds of people, and requiring precise timing, were frequently needed in the changing environment. A better understanding of human behavior and motivation and of cause and effect relationships were necessary. The environment dictated a more systematic study of the two fields. Donham aptly summarized this need for systematic study by stating that; "...otherwise business will continue unsystematic, haphazard, and for many men, a pathetic gamble." [37:1]

This is not to say that considerable knowledge and expertise about successful marketing and management techniques did not exist , but the knowledge was scattered and was often intangible information passed from one executive to his subordinate. [36:234]

Early writings on the subject of the systematic study of marketing and management came from experienced practitioners, knowledgeable in the guiding principles of their respective fields. These observations of experienced practitioners, though not sophisticated in terms of scientific techniques, were important, for they were the first attempts to identify and enunciate principles that might have universal application.

Coupled with these published observations was the increase in recording of facts and figures concerning marketing and management phenomena. This was significant, for

the recording and collecting systematically, over a considerable period of time, the facts about phenomena, led to the development of laws and principles which explain and predict the future . . . facts alone can give a wider and more scientific background of experience and bring about a broader use of precedents. [37:5-7]

Thus, the combination of recorded facts and written observations provided the impetus for viewing the two fields through a "science" lens.

Again, Donham reenforces this view:

. . . methods of science research vary but the conception that scientific studies should be approached through the collection and classification of facts and through the

development from recorded facts into generalization and theories into which facts are fitted is the basis of all science. [37:5]

This process of recording facts and developing laws, principles, generalizations and theories is an evolutionary process. The period of the 40's revealed the functions of management (and to a large extent marketing); whereas the decades of the 50's and 60's provided many of the principles that enabled formulation of systems theory and philosophy.

[38:3] Although the theory formulation was "primarily observed and evolved, it was nevertheless added to and refined by the establishment of hypothesis and applications of empirical tests." [38:2])

With the evolution of marketing/management research, different schools of thought and different approaches were proposed as possible explanations of the recorded facts and observations. [34,39:1,1] This variance in theories is not uncommon. It is not only a sign of the "unsophisticated adolescence of the field," [34:1], but it is also characteristic of the Kuhn Paradigm Model, discussed in Chapter III. The important point to remember is that theories are needed to advance the understanding of the field. Practical application and testing of the theories will determine their validity and accuracy.

The period of the 60's contributed greatly to the advancement of the science argument. Several symposia and conferences were conducted for the sole purpose of

articulating and compiling the various theories and schools of thought. In 1962, one such management symposium, entitled Management Theory and Research: Their Role in Improved Management, concentrated on "the varieties of approaches to management theory and research, the problems of synthesis, the needs and contributions of practitioners and the role of business schools." [40:xi] The 1960's also saw the establishment of the Marketing Science Institute, devoted to "fundamental research" in the field of marketing. [35:1] Also, the publication of several books dealing with the "use of science or its results by managers responsible for marketing decisions" [35:1] occurred during this period.

Thus by the 1960's, the debate and examination of the marketing/management science issue was fully underway. This debate continues today.

Although it may appear that these two fields are well on their way to science designation, this is not necessarily true. Many problems and issues need to be completely resolved before such a designation could occur. These major issues and problems will be addressed in the next section.

C. BEHAVIORAL SCIENCE ISSUES

Many people have publicly exclaimed that any field of study involving the analysis and prediction of human behavior can never be considered a science because of the seemingly insurmountable problems and obstacles facing such

a field and the apparent lack of scientific certainty. Table 3 is a synopsis of the various arguments put forward by the opponents of the behavioral science debate. This synopsis was developed by the researcher through a review of the literature which discussed the marketing and management science controversy. The table is not all-inclusive, but rather lists those major arguments levied against the "science" proposition. Each argument will be examined separately.

1. Elusive, Complex Subject Matter

The thrust of this argument is that since observed behavior, in any social field, is influenced by many variables, "it is difficult to isolate the effects of any one or any small combination of variables." [35:5] Consequently, it is nearly impossible to measure the impact of specific variables and to accurately determine cause and effect relationships. Charles Ramond suggests three reasons for this "elusiveness." [35:5]

- a. Human behavior is "tightly coupled;" variables affecting human behavior interact to such an extent that the "other-things-being-equal" assumption cannot be made.
- b. Human behavior models cannot be represented by simple linear models (in contrast to physical sciences). The complexity of the variables rules out this type of model as a method for visualizing abstract concepts.
- c. Human behavior is highly dynamic. Relationships which seem to describe a system today may not hold for the future.

TABLE 3

MAJOR PROBLEMS AFFECTING BEHAVIORAL SCIENCE STUDIES

Item	Issue	Argument
1	Phenomena too complex Subject too elusive	The interactions of human behavior are difficult to explain or control; The number of possible action/reaction combinations are limitless; difficult to isolate the affects of any one or any small combination of variables
	a. Inadequate measurement	The requirement that general propositions be designed to crystallize and organize further thinking and be subject to verification, modification and refutation is difficult to meet in behavior studies. Human relations propositions can only be evaluated subjectively.
	b. Impossible to synthesize behavioral science finding	Cannot synthesize findings by stating general propositions about phenomena in which, under certain specified conditions, the practices of the field studied can be derived. Conditions are always changing, thus findings have no meaning.
2	Scientific methods or techniques are not applicable	Social science phenomena differ in kind from those of physical sciences, therefore different methods have to be used to study them.
3	Semantical confusion	No common agreement on critical definitions necessary for establishing a systematic study of a particular field.

TABLE 3 (CONTINUED)

Item	Issue	Argument
4	Management of human behavior is an "art," not a science	Marketing, management (contracting) personnel apply findings of many different sciences for achieving solutions to problems; the use of knowledge from other sciences is a skill to be acquired.
5	Misunderstanding of principles/different or conflicting views	Tendency of some practitioners (managers) to believe principles will solve all problems, thus there is some discouragement and disillusionment when problems are not solved as hoped. Different points of view exist as to interpretation of facts; this creates confusion for practitioners.

Source: Developed by researcher through review of literature

Supporters of this view maintain that the findings of any research in the human behavior arena are very suspect and cannot be relied upon for making accurate decisions or predictions. The uniformity of the phenomena is lacking, therefore, what is missing are ". . . the highly reliable generalizations with which science has been identified."

[27:320]

This argument is based upon the premise that human behavior cannot be predicted because people independently determine their actions. To some degree, this premise is correct, however, the argument ignores the truth that ". . . the stability of behavior of groups and the tendency

of individuals to conform to the group pattern constitute a uniformity sufficient for making valid and reliable predictions." [27:320] Although group predictions may not be applied to individuals, predictions of individual responses may not be necessary for studying marketing, management or contracting.

2. Inapplicability of Scientific Method

The positivism/empiricism argument concerning the conduct of scientific research and the scientific method, mentioned in the previous chapter, has its basis in the proposition that science rests on a secure observational base. Repetitive empirical testing is held to be the sole means of validating research. To proponents of this view, scientific techniques and the scientific method cannot be applied to human behavior studies because the observations and conditions will change over time. In effect, replication cannot be accomplished. Without the repetitive empirical testing characteristic, research results cannot be validated by impartial, unbiased, third party researchers.

This argument is flawed on several counts. The first count concerns the issue of replication. What is important here is not that the experiment can be copied in every detail, but rather that the experimental results being reported can be "shared." [41:130] Instead of asking the question, "Can this study and finding be replicated?," what should be asked is the question "To what extent can the

results of this study be exported?" [41:130] This approach highlights those restrictions influencing an experiment and also stresses the durability of research results. The "sharability" of research results to similar situations, not identical situations, is evaluated and emphasized.

Another argument mitigating the scientific method inapplicability position involves the notion of probabilities. Probability theory has increased in sophistication and utilization. As a result, probability theory has become a powerful tool for specifying research results. Predicting "most probable" behavior is significantly better than not predicting behavior at all. [26:31-35]

Finally, the whole foundation of the positivists school of thought is not especially appealing. Many factors affect the conduct of scientific research, including the personal bias of the researcher himself. It is extremely difficult to say there is one best or unique scientific method. [29:25] The scientific method is a means of obtaining valid research for the discovery of laws and principles, however, ". . . the employment of such methods does not evolve a science . . ." [27:325] The scientific method is an acknowledged procedure, however, this procedure is a relative concept; having different meaning and applicability to different disciplines. To quote one source, ". . . it is more important to ask what

methodologies will convince the community of a particular research product, then to ask what is the correct method." [29:25] Each discipline must acknowledge the method that will be used for research validation and act accordingly.

3. Semantics

In human behavior sciences, considerable debate arises in articulating exact definitions for key terms. Words such as management and decision-making conjure up different mental images for different people. Problems exist when there is no general agreement concerning key terms used in social science research. With regard to this problem, Agnew and Pyke identified three different types of language as: [41:25]

- a. Pragmatic: level of usage where rules are personal and flexible and words are abstract or vague
- b. Objective: level that deals with objects that can be seen and agreed upon
- c. Syntatics: level that is concerned with rules for attaching words, symbols or numbers; the language of mathematics and logic.

Research employs all three levels of language and often it is not apparent whether a word belongs to the objective or pragmatic level. According to McAgnew and Pyke,

. . . probably one of the major weaknesses in the area of social or medical research is the failure to appreciate the problem deeply and to be able to make appropriate tests so as to determine the degree of vagueness surrounding the use of the word. [41:31]

The remedy to this problem is twofold. First, researchers must become more "aware" of the semantic problem so that a

conscious effort is made to express terms on the objective level. Second, a concerted effort is needed to clarify much of the language used by a particular discipline.

4. Art versus Science

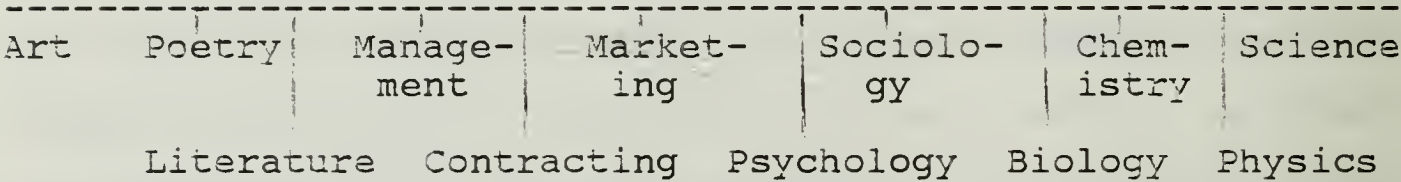
Hutchinson, among others, maintains that marketing (and because of the similarities, contracting) is not a science but, rather, an art, ". . . in the practice of which reliance must be placed upon the findings of many sciences."

[42:293] This line of reasoning holds that many of the different fields within the social science category are not really sciences but instead are separate disciplines that seek solutions to problems which require different and specific combinations of techniques or approaches. How a person determines the specific combination of techniques or approaches is an indication of skill (or art), not science. To the supporters of this argument, a scientist's search for knowledge concerning a particular problem cannot be equated to a practitioner's use of the knowledge to solve a problem.

[43:64-65; 42:290] Although various aspects of the field may be made "less haphazard" in terms of applying the knowledge, the subject matter itself "can never be a science." [43:65]

This art versus science distinction seems to be disappearing with the realization that one approach does not rule out the other. Actually, the concepts of art and science can be considered the two endpoints on a continuum

of fields seeking general consensus. [44]) Figure 4-1 indicates that near the science endpoint lies those fields of study that are amenable to general consensus (definition of science), while at the art end of the continuum would lie those fields of study that are not amenable to general consensus. Thus chemistry and physics would fall near the science endpoint, whereas poetry and literature would be grouped towards the art side. In between the two extremes would lie many fields that possess qualities of both art and science.



Source: Researcher through material provided by Joseph Hood, Ph.D.

Figure 4-1 Art-Science-Continuum

The development of laws and theories, generally agreed upon, would reduce the element of chance and uncertainty by providing a tested base for judgement and decision-making. [45:103] This, in essence, shifts the field of study along the continuum towards science and away from art. The concept of art is still applicable, however, for the skill or "art" of applying and utilizing the body of knowledge is still a crucial and necessary aspect of the

field of study. As can be seen from this illustration, the dividing line between science and art is not fixed, but is constantly changing.

5. Conflicting Views/Misunderstood Principles

One of the major criticisms lodged against the fields within the social science category is that there are too many contradictory explanations as to why particular phenomena occur. To a certain degree this is true. As more research is conducted, more facts are uncovered and more relationships are determined. Fitting these new discoveries into a logical and coherent explanation takes a great deal of time and insight. It is no wonder that some confusion and contradiction exists. In addition to this aspect of theory building is the reality that different individuals within the field, in an effort to "carve out" a distinct or original approach, may sometimes downrate or misrepresent what anyone else said, or thought, or did. [34:25] This often creates problems. According to Koontz, ". . . the varied approaches to management theory have led to a kind of confused and destructive jungle warfare." [34:25] Coupled with this confusing and contradictory nature of research within the field is the misunderstanding by practitioners of the true nature or meaning of a particular principle or law. There is a tendency of many practitioners to believe a principle or theory will answer all the questions and explain all the unknowns. Consequently, when this does not

happen, there is much disillusionment and cynicism on the part of the practitioner. [40:246]

Two things must be remembered concerning this issue. First, confusing and contradictory explanations or theories are part of the evolution of science. Any attempt to explain phenomena that encompasses so many variables as the social sciences do, is bound to leave some questions unanswered and to create some confusion. Gradually, as more facts become known, some theories will gain greater acceptance, while others will fall into disfavor.

The second consideration to remember is that theory, although it ". . . may not always be correct, can still be useful and fruitful." [35:4] Theory can form the skeleton on which the practitioner can build his own body of knowledge. Scientific theory cannot answer all the questions, but it can answer some of them, and thereby create an effective base for decision-making (art vs science argument).

D. ACHIEVEMENTS OF SCIENCE

As there are many arguments and controversies pertaining to the establishment of any science involving "human behavior" factors, it would appear that the values and achievements of "science" status must be great enough to counter the criticism and to warrant the effort involved in the determination process. Through a review of the

literature, several of these achievements and benefits have been identified.

First, science, and its characteristics, focuses on relationships. Science puts heavy emphasis on obtaining greater precision of relationships among phenomena under stated conditions. [45:104] Recording just facts and figures is not good enough; searching for cause and effect relationships is dictated by the science characteristics.

Secondly, science concentrates on the use of abstract concepts. Science attempts to simplify understanding of relationships through the use of abstract concepts which permit generalizations. [45:104-105] This abstraction feature is critical for gaining the general consensus necessary for a science. With the proliferation of facts and knowledge resulting from increased research, the ". . . integration of knowledge on higher planes of unification and abstraction . . ." is needed. [39:29] Science, because it places a high priority on the abstraction of concepts into generalized statements, can help in the integration/unification process. The development of abstract conceptual schemes also opens new frontiers in the human behavior arena and suggests additional avenues for observation and experiment. [46:51]

Thirdly, science allows for the development of operational definitions. Thompson mentions this aspect:

Science requires that concepts be defined by a series of operations which permit the sensory perception and

identification of the phenomena referred to by those concepts. Operational definitions make possible independent repetition of observations by scientists in many places at many different times. [45:105]

Finally, through science and the previously mentioned achievements, decision makers will be greatly assisted in their efforts to find solutions to perplexing and complicated problems. Old fashioned judgmental decision-making will be supplanted by a more scientific approach. [35:4] Greater certainty and predictability will be introduced into areas previously held to be uncertain or chaotic.

E. SUMMARY

Fields of study within the social science category have generated considerable controversy concerning their possibility of acceptance as a scientific field. This chapter reviewed the major arguments and issues of this science controversy. Although the arguments presented have some validity, their total applicability to the behavior science debate is lacking. The opposing arguments are not serious enough to foreclose the possibility of a human behavior field becoming a science.

A field of study meeting the requirements of a science gains much in terms of advancing knowledge. This is because "science" provides the framework in which individuals within the field must operate. Science characteristics and requirements demand that problems be approached in an

objective and analytical fashion, that research be scrupulously tested and validated, and that new ideas or knowledge be properly disseminated for critical examination and evaluation. Science provides the guidelines, the rules, and the norms by which individuals act and perform. By conforming to these "norms", "guidelines", and "rules", the trademarks of science are achieved and the frontiers of knowledge are pushed back. (Chapter VII will discuss the trademarks of science more in detail) This is not to say that a field can not progress without it being called a science; for it can. The progress, however, will be slower and more haphazard than in the case of a science. The fact that several acknowledged leaders within both the marketing and management fields (Thompson, Koontz, Hunt etc.) have voiced criticism concerning the quality and quantity of research conducted in the fields indicates dissatisfaction with the current method of operating. Objective and systematic analysis of the body of knowledge is lacking and it would appear that improvement is needed before any major advances will occur. Looking at the fields as a science may accelerate the sense of responsibility and concern needed to advance the fields.

The major achievements of science were discussed in the last section of this chapter. Since contracting is similiar to management and marketing, it would appear reasonable to conclude that contracting, from a human behavior

perspective, has the potential for achieving science status. Assuming this to be true, it now becomes necessary to determine if contracting actually meets the requirements of a science before deciding upon the question of "Can contracting become a science?" The next two chapters will address this issue.

V. A CONTRACTING SCIENCE

A. INTRODUCTION

Chapter Three laid the foundation concerning the specific concepts and ideas related to science philosophy. Chapter Four identified and discussed those issues confronting most disciplines within the social science category regarding their pursuit of "science" classification. Although Chapter Four stated that these "human behavior" related issues were not sufficient in and of themselves to prevent a discipline from obtaining science status, it still is necessary to determine if the characteristics of the discipline itself conform to the requirements of science. From Chapter Three, these requirements were determined to be:

1. A distinct subject matter
2. A description and classification of the subject matter
3. The adoption of the scientific method for studying the subject matter
4. The presumption of underlying uniformities and regularities concerning the subject matter.

This chapter will concentrate on the first three requirements. The following chapter will focus on the identification of those underlying uniformities and regularities pertaining to the field of contracting.

B. DISTINCT SUBJECT MATTER

Hunt states that one of the prerequisites for a field of study to become a science is for that field to have a "distinct subject matter" which can "serve as a focal point for investigation." [26:13] Before commenting upon this requirement, it will be useful to review some definitions of what exactly a contract is and what purpose it serves.

The Federal Acquisition Regulation (FAR) states that a contract is:

. . . a mutually binding legal relationship that obligates the seller to furnish the supplies or services (including construction) and the buyer to pay for them. It includes all types of commitments that obligate the government to an expenditure of appropriated funds and that, except as otherwise authorized, are in writing. In addition to bilateral instruments, contracts include (but are not limited to) awards and notices of awards; job orders or task letters issued under Basic Ordering Agreements; letter contracts; orders such as purchase orders, under which the contract becomes effective by written acceptance or performance; and bilateral contract modifications. Contracts do not include grants and cooperative agreements . . . [47: Section 2:101]

This definition of contract is taken from a government perspective and may not be as generalized as need be. A more accepted definition of contract is "an agreement between two or more competent parties to perform some legal act for consideration." [13]

Both of these definitions emphasize the legal aspect of the contract instrument and focus on those characteristics that have a basis in law.

Returning to the distinct subject matter criterion previously mentioned, Williams proposes that the distinct

subject matter of a contracting science would be, "the contract and related phenomena." [12:27] Although this definition is just a first attempt at defining the subject matter of contracting, it nevertheless has flaws that require comment.

Williams' proposed definition makes the contract the focus of the science and as such concentrates on the legal aspect of the discipline. The essence of contracting is not the legal aspect of the contract, rather it is the thought process and a continuum of decisions that are involved in the acquisition of goods and services within the marketplace. The legal quality of a contract is the glue that holds the process together. [17] The contract itself is a secondary product of the contracting process. Agreement is the primary product and the decisions and strategies used to obtain and execute that agreement are of primary concern. By stating that a contracting science is the study of the contract and related phenomena, it appears that primary emphasis is being placed on the contract, not the factors that lead to the contract. Although the term "related phenomena" broadens the orientation somewhat, to include the functions of the contracting process, the term itself is rather vague and abstract. What exactly are "related phenomena" to the contract? The term implies that those fields such as economics, finance, and law, that have relevancy to contracting, will be incorporated into the

science. The inclusion of these fields is necessary for the adequate examination of contracting phenomena, however, "related phenomena" can also mean the incorporation of many fields or disciplines (totally or partially) that have only a remote connection to the contracting process or contracting decisions. A more limiting and specific definition of the subject matter is needed if it is to serve as the focal point of investigation.

One possible candidate for the definition of the distinct subject matter of the contracting field is, "the study of acquiring goods and services in the marketplace by utilizing a contractual device." [17,48,26:13]

This definition emphasizes the "acquiring aspect" of contracting, yet a distinction is made between contracting, purchasing and acquisition. Contracting is not synonymous with either purchasing or acquisition. Acquisition, defined by Lorette; [49:14]

. . . is the process used by people to manage the integration of all activities required to obtain goods and services to meet a need. These activities include:

- * defining a need
- * soliciting and exploring alternative solutions
- * conducting tests and evaluations
- * choosing what to obtain
- * selecting sources
- * conducting price and cost analysis
- * advertising, negotiating, awarding, and administering contracts
- * budgeting and financing the above activities.

Purchasing is a method of accomplishing the acquisition function; contracting is a type of purchasing; one that is distinguished by the legal aspect of the contract. Other

types of purchasing ,such as bartering and auctioning, do not possess this contract feature. Certainly, contracting is similar to purchasing in terms of buyer/seller relationships and make or buy decisions, however, the utilization of a contract (with legal implications) alters those relationships and decisions. Those disciplines contributing to a better understanding of buyer/seller relationships and characteristics would be a part of the subject matter of a contracting science.

By stating, "in the marketplace," the proposed definition acknowledges external forces, governmental and nongovernmental, that affect the contract process and the contract.

The researcher contends that a contracting science must focus upon the contracting process, not just the contract. The exact nature of this process, however, is open to debate. Again relying on the Federal Acquisition Regulations, contracting is defined as including the functions of "description (but not determination) of supplies and services required, selection and solicitation of sources, preparation and award of contracts and all phases of contract administration." [47:Section 2:101] Contract administration encompasses many functions, including contract monitoring, receipt/payment of contracted goods and services, quality assurance and, in many cases, disposal of contracted goods. [11:60] Although this

definition appears to be rather all-inclusive, a key ingredient is missing. The importance of the user-contracting personnel interface is not stated or stressed. Although in many contractual actions this interface may not be important, in many others it is critical and needs to be examined. Restricting contracting science to the study of those actions that commence with receipt of a purchase request and terminate with disposal of the contracted good severely limits the boundaries of the science and hampers effective research. [19] Many contracting actions and decisions are based upon user decisions and actions, and it is essential that this aspect of contracting not be eliminated from a contracting science subject matter. In short, the FAR definition, in stating that contracting is "not determination" of goods or services, is too narrow in focus and scope. The concept of contracting needs to be broadened to include the function of user determination.

It can therefore be stated that the scope of contracting covers a rather broad area. Included are such diverse areas as: pricing decisions, buyer/seller behavior, cost analysis, negotiating techniques, contract planning, contract modifications, and quality assurance. One approach for viewing the scope of contracting can be through the matrix presented in Figure 5-1. This matrix uses the three categories of (1) Government/non-government, (2) certainty

	Descriptive	Normative
	(1)	(2)
Certain Items	<ul style="list-style-type: none"> * study of market forces * nature of product * Type of contract 	<ul style="list-style-type: none"> * managerial decisions * improved contracting * techniques (process) * cost of competition
Government Sector		
	(3)	(4)
Uncertain Items	<ul style="list-style-type: none"> * major systems contracting * R&D contracting * negotiating techniques * socioeconomic implications 	<ul style="list-style-type: none"> * buyer/seller relationships * How to improve major weapons systems contracting * How best to use socioeconomic laws
<hr/>		
	(5)	(6)
Certain Items	<ul style="list-style-type: none"> * contracting procedures * nature of item * comparative buying * buyer/seller relationship 	<ul style="list-style-type: none"> * social responsibility * cost of competition * how improve contracting process
Non-Government Sector		
	(7)	(8)
Uncertain Items	<ul style="list-style-type: none"> * nature of item * market factors * legal aspect of contract 	<ul style="list-style-type: none"> * stimulating demand * social responsibility * role of contracting in economic development * how predict demand

Source: Developed by researcher through compilation of research references and personal interviews

Figure 5-1 The Scope of Contracting

or uncertainty, and (3) normative/descriptive as a method of classifying contracting characteristics and phenomena. In this scheme, Government includes all Federal, State, and Local Government contracting actions; non-government refers to private industry contracting exclusively. "Certainty" pertains to those goods or services for which qualities and characteristics are known; "uncertainty" concerns those goods or services for which a definite understanding of the characteristics or requirements is lacking. [19] Certainty/uncertainty implies a continuum. The location of a good or service on that continuum is a major factor in the determination of the market that will provide the item. The descriptive category refers to the process of describing, explaining, predicting, and understanding contract phenomena as it actually exists. The normative category however, adopts the perspective of what the contracting processes and policies should or ought to be.

All individuals within the contracting field may not agree with this contracting matrix; however, it is used here as a working method for purposes of explaining the scope of contracting.

Although difficult to state with complete confidence, it would appear that much of the initial work and research performed within the contracting field is centered around block (1), Government sector/certainty/descriptive; block (3), Government sector/uncertainty/descriptive; and to some

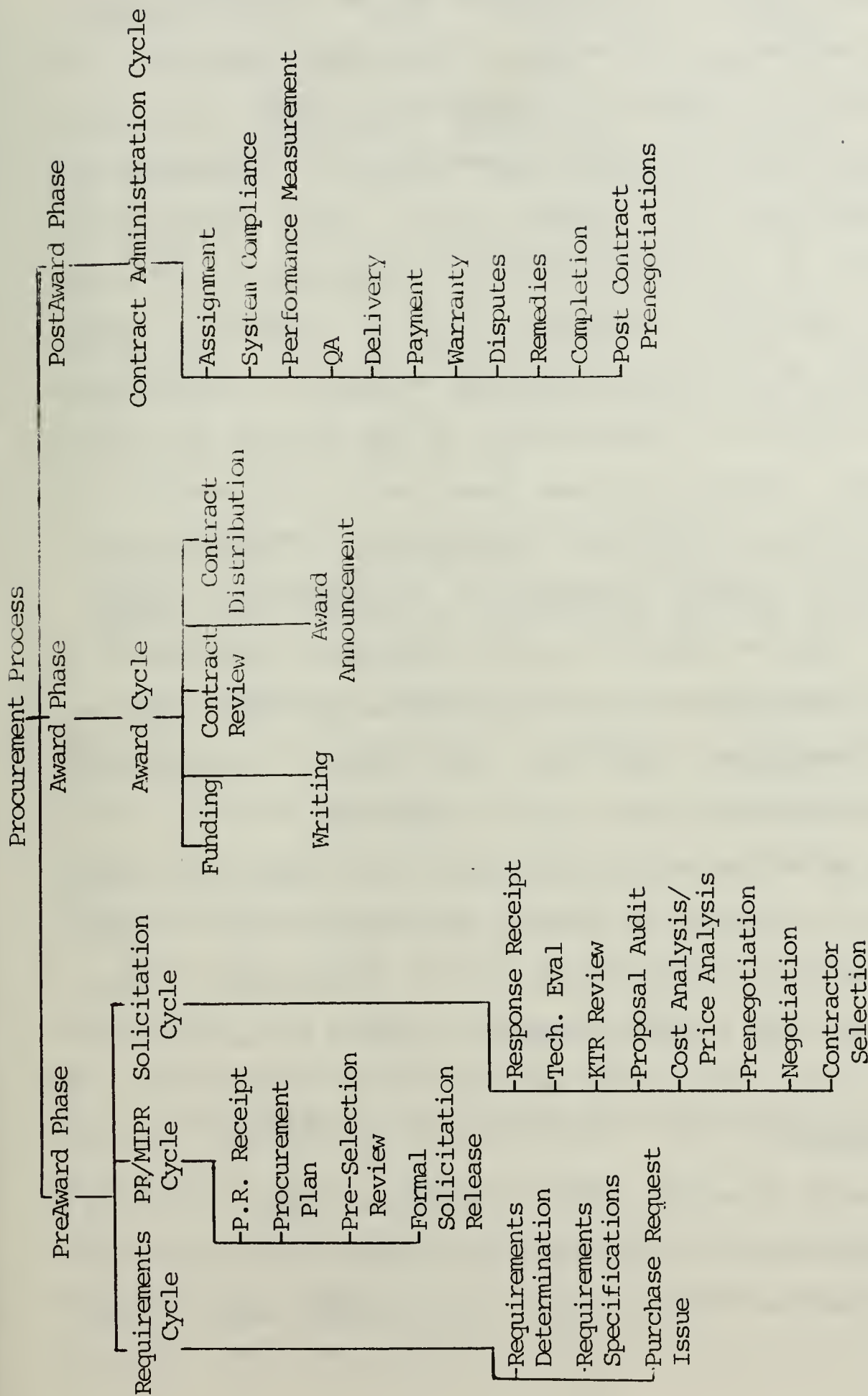
extent, block (5), non-government sector/certainty/descriptive. Recent research and study has expanded this focus to include block (2), Government sector/certainty/normative (streamlined competitive acquisition procedures), and block (4), Government sector/uncertainty/normative (Packard Commission). Very little emphasis has been placed on blocks (6), (7), and (8). The reasons for this concentration of research within the government sectors are the very reasons identified in Chapter II; the growth of the Government budget and the increased importance of the contract in establishing national policy.

Although this concentration of effort within the Government sectors is necessary, it can be argued that additional work is needed in the non-government sectors. The scope of contracting, as defined here, would include all eight blocks and the boundaries of a contracting science would incorporate these blocks.

In conclusion, as the first distinguishing characteristic of science is that it relate to a distinct subject matter, contracting, to the extent that it can be considered the study of acquiring goods and services in the marketplace through a contractual device, would appear to fulfill this requirement.

C. DESCRIPTION AND CLASSIFICATION OF SUBJECT MATTER

The identification of a distinct subject matter leads to the second requirement of science; namely, the description and classification of the subject matter. Hunt states that a classification scheme "is a type of non-theoretical system which sets conditions for the applicability of its categorical terms." [50:66] Classification schemes may be simple or complex and can be expanded either "latitudinally or longitudinally." [50:66] The importance of classification schemes is that they order the universe of the subject matter and assist in the development of theories. Preliminary work on a classification of the procurement field has previously been accomplished by Heuer, Kingston and Williams in their 1977 master's thesis: "A Proposed Definition and Taxonomy for Procurement Research in the Department of Defense." Figure 5-2 is a graphical representation of the proposed taxonomy. Although the Heuer et.al. taxonomy specified five levels of a hierarchial structure, (process, phase, cycle, event, issue); for ease and clarity, only the top four levels of the taxonomy are illustrated in Figure 5-2. The proposed taxonomy, although labeled a "procurement taxonomy," might well serve as the basis for a contracting science classification scheme. The phases, cycles and events identified by Heuer et al. for their taxonomy appear to conform to the functions identified in the contracting definition mentioned in the



Source: A Proposed Definition and Taxonomy for Procurement Research in the Department of Defense by Heuer, Kingston, and Eddie Williams

Figure 5-2 Procurement Research Taxonomy

previous section. Utilizing this taxonomy, most if not all of the subject matter of contracting can be classified into one of the taxonomy categories. Additional work may be needed to refine and update the proposed taxonomy.

One point needs to be made concerning the "Procurement" taxonomy presented in Figure 5-2. This particular classification is a process-oriented taxonomy in that it defines the distinct categories along a sequential time line. Although this is an acceptable method of classifying the subject matter of contracting, it may not be the best classification. Another scheme, more useful for developing theories and for providing an understanding of the subject matter, may be needed. Possibly a classification scheme based on the type of good or service obtained (standard vs. unique), the different types of sellers, or the various contracting functions might be more useful. Additional research is required in this area of interest.

With regard to the second criterion, the description and classification of a subject matter, preliminary work in this area indicates that contracting can be classified in some manner or form. The second criterion appears to be met.

D. ADOPTION OF THE SCIENTIFIC METHOD FOR STUDYING THE SUBJECT MATTER

Perhaps more than any other criterion, application of the scientific method to the study of a specific subject, is often identified as the boundary line between what is and

what is not a science. [29:18] As previously discussed (Chapter III), the scientific method is an ". . . investigation of nature by means of observation, induction, hypothesis, experiment, calculation, prediction and control." [11:45] It has also been discussed that although the scientific method has procedures or techniques generally recognized and accepted by the scientific community, these procedures may and will vary from one discipline to another. These differences in the application of the scientific method are

. . . imposed by unique characteristics of the field under study--not by a difference in the scientific method. . . . These differences in application are not necessitated by nature, but rather the differences are the result of human limitations in applying the scientific method. [11:46]

Ziman supports this concept of human limitations in the application of scientific methods, particularly in the social science category: ". . . the idea of consensus is there, but the intellectual techniques by which it might be created and enlarged seem elusive." [23:28]

Given the rather "soft" nature of the subject matter of contracting, in terms of human behavior and motivation, it may appear that the subject matter is too elusive to permit rigorous examination and analysis. This observation is not necessarily true. The ultimate goal of the scientific method is that the research product be accepted by the professional community. This is accomplished by having results freely published, reviewed, and criticized by the

community of contracting personnel. Although levels of rigor for accepting research results may not be high initially, the levels will increase as more contracting professionals become more concerned about the credibility and reputation of the discipline. The adoption of higher levels of rigor will force the use of more stringent and reliable methods of testing. Thus, individuals or organizations promoting a new idea, concept or theory need not be concerned with determining the one true and correct scientific method, but rather the method which will convince the targeted community of the validity and soundness of the particular idea, concept or theory. [29:25]

Obviously, research conducted in a rigorous, well-structured manner will more likely achieve consensus than that conducted in a haphazard, undisciplined fashion. The task for a researcher is to design and follow an approach that is best able to obtain the general consensus that is required before the product is considered credible and reliable. This approach to the application of the scientific method adheres to the relativistic/constructionists school of thought mentioned in Chapter III.

Some work concerning scientific method application has been accomplished. Table 4 illustrates one type of approach that may be utilized in conducting contracting research. This technique, proposed by Heuer, Kingston and Williams, is not a specific method, but rather it is a question list that

TABLE 4

SCIENTIFIC METHOD QUESTION LIST

1. Does it define the Problem?
2. Does the effort survey existing pertinent literature
3. Has the researcher evaluated past studies for applicability to his effort?
4. Does the effort build on previously developed knowledge?
5. Is the scope defined and specified, and are the specified objectives to be met, listed?
6. Does the effort suggest the testing of a hypothesis or the answering of a research question?
7. Is there a specified plan?
8. Does the effort list assumptions/limitations?
9. Is the methodology logical and appropriate for the objectives specified?
10. Does the effort gather data and/or facts?
11. Are the data valid and reliable?
12. Does the effort report, describe, predict or explain?
13. Do conclusions logically flow from the data?
14. Can the effort be replicated to achieve consistent results?

Source: A Proposed Definition and Taxonomy for Procurement Research in the Department of Defense by Gerald R. Heuer, Major, USAF, John C. Kingston, Captain, USAF, and Eddie L. Williams, Captain, USAF

identifies those areas and considerations individuals need to be aware of when conducting research. Addressing the questions of Table 4 increases the likelihood that the research will be accepted by the contracting community.

Regardless of the exact method followed in proving or disproving hypothesis and in conducting research, the vitality of the scientific process lies in the three areas of:

1. speculative thinking
2. deductive reasoning
3. empirical observation. [46:52]

The degree of rigor involved in these three cognitive processes, particularly 2 and 3, will determine the degree of acceptance accorded the results.

To the extent that contracting researchers can perform the process described above, and to the extent that general consensus can be achieved on rigorously conducted, well-designed research, the criterion of science concerning the application of the scientific method to the field of contracting can be met.

One final comment concerning application of the scientific method needs to be made. The requirement that research results be generally accepted by the contracting community is a rather difficult and stringent requirement to achieve. Conducting research in a manner that meets this requirement will undoubtedly require a rigorous and

disciplined technique. Having one scientific method to which all contracting research conforms to is not only impractical but also impossible.

E. SUMMARY

This chapter discussed three of the four requirements of science. The criteria of 1) distinct subject matter, 2) a description and classification of the subject matter, and 3) the application of the scientific method for studying the subject matter were all examined and commented upon.

A definition for specifying the distinct subject matter was proposed. In addition, a classification or taxonomy of the subject matter of contracting was presented. Although the taxonomy may not be the best method of classifying the subject matter, it does offer one way of ordering the universe of contracting. Finally, the concept of general consensus and its relationship to the scientific method was explained and analyzed. The requirement that research results be generally accepted by the contracting community was determined to be the major consideration in designing a methodology for conducting research.

Chapter VI will address the last stated requirement of science: the presumption of underlying uniformities and regularities concerning the subject matter. In the somewhat abstract and volatile field of contracting, this requirement was considerably more difficult to evaluate.

VI. UNDERLYING UNIFORMITIES AND REGULARITIES

A. INTRODUCTION

The last requirement a discipline or field of study must meet before it may be considered a science pertains to the presumption of underlying uniformities or regularities among the phenomena which comprise the subject matter. The discovery and identification of these underlying regularities can lead to empirical laws, principles, and theories. This chapter will attempt to identify several principles that are generally accepted within the contracting community; the assumption made here is that if contracting principles exist, then the underlying uniformities and regularities on which the principles are based can also be identified. By demonstrating that principles and uniformities are a part of the subject matter of contracting, the last hurdle to science classification for the contracting field would theoretically be overcome.

A principle, in the context used herein, is considered to be a general proposition sufficient to the series of phenomena under consideration to provide a guide for thought. A principle serves as a fundamental truth, a comprehensive law or doctrine from which others are derived or upon which others are founded. This definition is

significantly different from the normally held view of principles being simply rules of action. [27:322]

B. METHODOLOGY

As stated in Chapter I, the methodology used for the identification of contracting principles consisted of conducting personal interviews with individuals knowledgeable in contracting methods and phenomena. The objective of this methodology was to have the interviewees highlight those concepts which might serve as principles for a "contracting science." This phase of the methodology was concerned with the identification of "concepts" which could serve as contracting principles. The actual phrasing and qualifying of the identified concept was performed at a later stage.

Ten interviews were conducted with eleven different individuals. (Two people participated in one interview.) Once the individual opinions concerning contracting principles were expressed, a consolidation of the various opinions and ideas into categories of similar characteristics was performed. A matrix was developed to determine the number of times a particular conceptual category was mentioned by the different interviewees. The premise of this particular research approach was that if contracting principles did exist, then most, if not all, of the interviewees would be aware of the basic concept of the principles and state them as such during the interview. A

consensus was needed to demonstrate that a contracting principle was supported by corroborative evidence concerning validity and reliability and that many people within the field agreed with the evidence. Without general agreement concerning concepts of contracting principles, the assumption was made that the evidence corroborating the concept was not substantial or significant enough to win general approval.

Although eleven individuals is an extremely small sample on which to base conclusions, it was felt that the ten interviews would be sufficient to provide insight as to which ideas might be contracting principles. The limitations of time and money prohibited a more extensive and broader-based research approach.

Once the concepts of contracting principles were expressed and categorized, the criteria on which principles and laws are evaluated and judged were applied (see Chapter III). This procedure was necessary to determine if the expressed concepts met all the criteria and requirements of principles (laws); not just the universal agreement criterion. Once this procedure was accomplished, those concepts meeting the criteria were listed as "potential" contracting principles. The term "potential" is used because more agreement and acceptance is required than that provided by the research sample.

C. CONCEPTS OF CONTRACTING PRINCIPLES

Table 5 represents the results of the consolidation of the various expressed opinions concerning possible contracting principles. As can be seen from the Table, Item 1, the primary objective of negotiations is to reach a fair agreement, was expressed by six of the eleven interviewees as a principle in contracting [19, 51, 48, 52, 53, 54]. The emphasis of this concept was that parties enter into negotiations with the intent of reaching an agreement that is fair and reasonable to all parties involved. If this was not true, then negotiations would be either short-lived or nonexistent.

Four of the interviewees stated that the environment of a contract, both external (outside the organization which is a party to the contract) and internal (within the organization) affects the effectiveness of the contract and performance of the contractual parties (Item 2). [55, 17, 48, 56]. The thrust of this concept was that different variables influence the contract, on a constant and continuous basis, during the life of the contract. The contracting environment is a dynamic environment and the flexibility designed into a contract determines the effectiveness of contract performance.

Four interviewees also agreed to the concept that price is a function of the good or service contracted for. [17, 13, 48, 56]. Goods and services are classified on a scale

from standard to unique characteristics. Because of these characteristics, price of a contract is determined by the marketplace (number of sellers), demand for the product (strong/light), cost of the components (material, labor), and skill of the negotiating personnel. (Unique items usually require more experienced negotiators, standard items usually demand less experienced individuals.)

Item 4 had three individuals expressing the same idea regarding a possible contracting principle. [13, 48, 56] Item 4 concerns the concept of competition; that is, in the absence of competition a less effective contract will probably occur. This concept is similar to Item 3 in that price, as a function of standard or unique characteristics, is determined, in part, by the marketplace. Item 4, however, is more specific and more narrowly focused than Item 3. Competition, as used here, means all types of competition, including price, quality, design, etc.

Item 5, upon which three individuals agreed, pertains to the motivation of the parties involved in the contracting process. [54, 52, 48] Individuals expressing this concept indicated that each party to a contract is motivated by different factors and that each acts to satisfy their own needs. Variations of this theme are listed under Item 5. This concept is different than the concept of general agreement identified in Item 1. Although the overall goal of the contracting parties is to reach agreement, each party

TABLE 5

CONCEPTS OF CONTRACTING PRINCIPLES

CONCEPTS	TOTAL
1. Principal objective in negotiations is to reach a fair agreement; contract satisfies needs of parties.	6
2. Different environments affect contracts in different fashion; change process and effectiveness of contract.	4
3. Price is a function of unique good vs. standard good determined by: <ul style="list-style-type: none"> a. marketplace b. demand c. cost d. negotiating effect. 	4
4. In the absence of competition, less effective procurements will probably occur.	3
5. Parties are motivated by different factors; each party acts to satisfy its own objectives; each party will try to obtain leverage over the other in order to meet objectives; each party will try to make content of contract favorable to own objectives; each will add provisions to contract to make certain behavior occur.	3
6. Have broadest range of choice to meet system need: concept of alternatives.	2
7. Sequential time phased process with multiple paths; nature of products determine path.	2
8. Parties to contract intend to fulfill agreement; promise to pay, promise to perform.	2
9. Changes to contract are evolutionary and in harmony with the peculiarities of the time period and society in general.	2
10. Contract is for acquisition of goods and services in the marketplace; economic exchange; product matches the market.	1
11. Each party has a right not to enter into an agreement.	1

TABLE 5 (CONTINUED)

- | | |
|--|---|
| 12. Contract types are irrelevant to contract performance. | 1 |
|--|---|

Source: Developed by researcher

will approach that goal in a different manner and will be motivated by different factors. This concept pertains more to the "means" of negotiations, whereas Item 1 is concerned with the "end" of negotiations.

Items 6 through 9 list those concepts for which two interviewees expressed preference, while Items 10 through 12 were concepts articulated by a single interviewee. Items 6 through 12 were eliminated from further study. The justification for this elimination was that the basic premise used in the methodology, that individuals experienced in the contracting field would be able to express those concepts which might be called contracting principles and from which consensus could be obtained, was not met with Items 6 through 12. The expression by only one or two individuals does not provide a reasonable base for saying some type of consensus was obtained on these particular concepts. Items 6 through 12 are listed in Table 5 as an indication of what some additional ideas might be regarding contracting principles. Additional work and research is required in this area.

It can be argued that those concepts expressed by just three, four or six individuals do not conform to the consensus requirement previously mentioned. This is, in fact, a true statement. Given that, at the most, only six individuals identified a particular contracting principle or concept, the requirement of overwhelming support and evidence is obviously not met. In the strict application of the principles criteria, none of the identified concepts can be called contracting principles, since universal agreement was lacking.

Although not meeting the consensus requirement, Items 1 through 5 of the matrix were examined in greater detail. The other criteria of principle determination were applied to the five expressed concepts. The intent of this procedure was to decide if any of the five concepts might qualify as a principle should more evidence supporting the concept be obtained and more acceptance be won. The next section discusses this procedure.

D. CANDIDATES FOR CONTRACTING PRINCIPLES

Chapter III identified (1) generalized conditional, (2) empirical content, (3) nomic necessity, and (4) systematically integrated, as the four criteria that must be met before a regularity becomes a lawlike generalization, a law, and ultimately a principle (see Figure 3-1, Chapter III). Although, according to Hunt, these criteria distinguish empirical regularities from "lawlike" generalizations, the

criteria will be applied to the concepts previously identified to determine their possibility of becoming contracting principles. Since principles are basically a higher order of "law-like generalities," it would seem reasonable that a candidate for a contracting principle must first satisfy these four criteria.

1. Principal Objective of Negotiations Is to Reach An Agreement

Although this concept can be expressed as a generalized conditional, "If an agreement between parties is obtained, then the principle objective in negotiations is achieved"; this generalization is basically nothing more than an analytical statement. Negotiations are initiated to achieve an agreement. Why else would negotiations be conducted? In fact, the definition of negotiation is "mutual discussion aimed at agreement." [57:891] This conditional is true regardless of the real world facts. It makes no assertion about the real world and is true because of the terms used in the statement. It is a true analytical statement, not a principle and is therefore rejected as a candidate for a principle without further analysis.

2. Different Environments Affect Contracts in Different Fashion and Can Affect the Effectiveness and Process of a Contract

This concept, stated as a generalized conditional would be: "If the environment and assumptions upon which a contract is negotiated are varied, then the process and effectiveness of the contract will change."

This generalization implies that the occurrence of some phenomena (variance in environment/assumptions) must be associated with some other phenomena (change in contract effectiveness and process). This relationship does not appear to be accidental; therefore, the nomic necessity requirement appears to met.

The generalized conditional also meets the criteria of empirical content. Through empirical study, the statement can be proven or disproven. Kennedy and others have already performed some research in this area and have drawn several conclusions pertaining to the affect of environmental factors upon contract performance and effectiveness. [58:212-213] As for the criterion of systematically integrated, the stated generalization has a niche in contracting thought and thinking; it is not an "isolated assertion having no theoretical ramifications." [26:72]

In conclusion, the concept of differing environments, utilizing the four criteria specified by Hunt, has the characteristic and potential of becoming a contracting principle.

3. In the Absence of Competition, Less Effective Procurements Will Probably Occur

The phrasing of this concept into a generalized conditional would be something along the lines of "If competition is lacking in a contracting action, then a less effective contracting result is probable."

This generalization also appears to meet the other criteria used for judging principles: empirical content, nomic necessity and systematically integrated. The "truth" of the conditional can be either proven or disproven. Much has been published concerning the impact and effect competition has upon contractual actions, and this area has come under closer scrutiny within the last several years. The generalization does not specify an "accidental" relationship, one occurrence of phenomenon is associated with another occurrence. Finally, the concept of competition is a fundamental aspect of the contracting process and it is definitely "systematically integrated" with other aspects of contracting. The concept of competition can, in all likelihood, contribute to the formulation of contracting theory. Given that the concept appears to meet all four of the principle criteria, it would be reasonable to state that this idea also has the potential for becoming a contracting principle.

4. Price, As a Function of Whether the Good/Service Is a Unique or Standard Item, is Determined by Market-Place Forces, Demand, Cost and Negotiation Effectiveness

This concept of price being a function of either unique or standard characteristics and being determined by the factors of market forces, demand, cost, and negotiating effectiveness, is actually two separate and distinct concepts. One concept pertains to the determination of price because of the characteristics of the good or service

being obtained (standard or unique), whereas the other concept involves the determination of price because of the various combination of factors involved. (market forces, demand, . . .) Stated separately, the generalized conditional statements might be; "If the nature of the good changes along a continuum from standard characteristics to unique characteristics, and vice versa, then the final price will change" and "If the mix of factors, determining price, are altered, then the price of the item will change."

Both of these statements would appear to be empirically testable; that is, the truthfulness or validity can be supported through the study of pricing decisions and the evaluation of the effect the various price determinants and nature of the product have had upon the price.

The generalizations do not imply an accidental relationship; one occurrence (price) is related to another occurrence. (nature of the product or the mix of variables) Empirical tests would probably support these relationships.

The last criterion, of systematically intergrated, could also be met with the two generalizations. Certainly, the price determinants of cost, demand, and so forth have been an accepted part of contracting philosophy and, in fact, influences many of the actions taken within the contracting arena. The concept of price being a function of the unique or standard characteristics of the good or service is also a central component of contracting thought.

It would be reasonable to state that both of these concepts can and will give rise to other contracting theories and hypothesis.

These concepts then, when separated to express the two different lines of thought ,meet the criteria for judging principles and should therefore be considered as candidates for contracting principles.

5. Parties to a Contractual Relationship are Motivated by Different Factors

This concept can be expressed as a generalized conditional in the form of "If the motivations of a party to a contract are altered, then contractual behavior of the party will also change" Although somewhat difficult to determine, this generalization appears to have empirical content in that examination of facts obtained in actual situations supports the generalization. More research is needed to fully determine the correctness of the statement.

Preliminary work has already been performed in this area. One study, conducted by Williams, focused on those factors and considerations which motivated defense contractors in their performance of defense contracts. [59:24-32] The study provided interesting results concerning the difference in perspectives held by members of the Government and members of the defense contractor community. This research and study would seem to indicate that the generalization is empirically testable and not just a "truism" or analytical statement.

The relationship stated in the generalized conditional also appears to be more than just an accidental relationship. The occurrence of one phenomena (contract performance) is tied to the occurrence of another phenomena (different motivational factors). From the generalization, different hypotheses can be proposed which will contribute to the corroboration of the generalization. Therefore, the criterion of nomic necessity appears to be satisfied.

With regard to the "systematically integrated" criterion, determination and evaluation of the motivation of different contracting parties is a central feature of contracting thought. Since the study and identification of those motivational factors affecting human behavior in general is the focus of the social sciences, it is only logical that the study and identification of those motivational factors affecting contracting parties be a central theme of contracting theory. This concept of contracting motivation appears to be pervasive throughout the contracting discipline.

Because the generalization of motivational factors affecting contract performance satisfies all of the stated requirements, the generalization can be considered a candidate as a contracting principle.

Of the five concepts examined and analyzed in this last section, four (five counting the separation of concept #4) of the concepts have potential for becoming contracting

principles. More refinement and agreement is required. These five "principles" candidates are listed in Table 6. It must be emphasized that these five candidates are simply that; candidates for contracting principles. More research and work is needed to fully articulate and identify the principle.

TABLE 6
CANDIDATES FOR CONTRACTING PRINCIPLES

<u>Item</u>	<u>Statement</u>
1	If the environment and assumptions on which a contract is negotiated are varied, then the contract process and effectiveness will change.
2	If competition within a contracting action is missing, then a less effective contracting action is probable.
3	If the nature of the good changes from standard to unique, then the price will change.
4	If the mix of factors determining the price are altered, then the final price will change.
5	If the motivations of a party to a contract are altered, then contractual behavioral will change.

TRUISMS IN CONTRACTING

- | | |
|---|---|
| 1 | Principle objective in negotiations is to reach an agreement. |
|---|---|

Source: Developed by researcher

E. SUMMARY

This chapter sought to demonstrate that underlying uniformities and generalities exist concerning contracting phenomena. The identification of potential contracting principles indicated that these uniformities and regularities do in fact exist. This is so because principles are based on uniformities of phenomena within the field of study.

Although contracting principles per se have not been specified, it does appear that several concepts or beliefs have the potential of becoming principles. Additional review, discussion, and refinement is needed before general consensus is obtained. This fact does not detract from the finding that underlying uniformities exist within contracting. Many people agree to the different concepts, and sufficient evidence is available to support the argument of underlying regularities. The difficulty is not in the agreement of the idea of uniformities, but in the expression of that uniformity. It was felt by the researcher that the articulation of potential contracting principles might serve as a means of expressing some of the underlying regularities. To a degree, this was accomplished; however, full identification of the underlying regularities remains a difficult task. Nevertheless, underlying uniformities do exist within the contracting field.

Having satisfied this last requirement of underlying uniformities, it would appear that all of the major arguments against the establishment of a contracting science have been removed. If this is true, the next question that should be asked is: So what? Just stating that a particular field of study is now qualified to be a science does not mean that the field will become more honorable, respectable, or credible. Certain attitudes, beliefs, and actions must change before a field becomes a true science. The following chapter will address these changes.

VII. THE PURPOSE OF A CONTRACTING SCIENCE

A. INTRODUCTION

The previous two chapters presented the argument that the characteristics of contracting are such that the establishment of a contracting science is a very real possibility. Not only does the field possess the necessary prerequisites, but it also appears that the contracting field will probably evolve into a science. Two observations support this view.

First, as mentioned in Chapter II, the Hood-Strayer Model concerning research progression states that the conduct of research transitions through different phases or stages of varying sophistication and refinement in terms of techniques and processes. Stage four of the model includes such characteristics as theory formulation and hypothesis testing. These characteristics are typical characteristics of a science. In fact, theory formulation and hypothesis testing are critical to the advancement and progress of any science. If the Hood-Strayer Model reflects real world occurrences with regard to the conduct of research, then it is logical to assume that contracting research will also progress through this stage and into successive stages. As the research passes through the higher levels of

sophistication and refinement, a greater push is exerted on the evolutionary process toward a contracting science.

The second piece of evidence supporting the evolution of a contracting science lies in the application of Kuhn's Paradigm Model. As expressed in Chapter III, Section D, Phase Two of Kuhn's Model is characterized by the creation of numerous contradictory and speculative theories that are tailored to explain some of the observed phenomena, but are incapable of explaining all of the phenomena. A review of the contracting discipline over the last several years would indicate that contracting is probably located in the "Phase of Discovery." Better methods of measuring and observing contract performance, contractor motivation, and so on have led to the development and expression of more and more theories that are capable of explaining and predicting some of the phenomena, but not all of it. Theories of pricing, negotiating, and contractor motivation, to name a few, have all been proposed by different people within the profession. Gradually, as research techniques advance, more sophisticated and abstract theories will be proposed which have greater explanatory and predictive power and which gain greater acceptance. In this respect, it is not inconceivable to state that a "paradigm" may be eventually achieved within the contracting field. Because this "paradigm" formulation and acceptance is the best indication

that a discipline is a science, it seems plausible that contracting will, in time, become a science.

Stating, however, that a field of study "qualifies" as a science does not mean it is a science. More is required than just stating that a field meets the requirements of science. To achieve true science status, the attitudes, actions and beliefs of those within the field must "qualify" as well. The following section will address this issue.

B. PERSONAL VALUES

To determine what "personal" values need to change before a field is truly a science, it might be useful to first examine the "trademarks" of science. Those "trademarks," which distinguish science from other news agencies, include: [41:8-10]

1. the emphasis on the accurate reporting of what was observed by the researcher
2. the experimentation and manipulation of data, events, and so on in order to obtain a better understanding of cause and effect relationships
3. the expansion of the scope of scientific information to include information that is of a lasting, generalized, wider applicability nature
4. the utilization of elaborate methods to minimize the number of errors that may creep into scientific research
5. the use of more detailed and objective language in any and all communications.

Underlying all of these science trademarks is the concept of responsibility as applied to both the researcher and the practitioner. Responsibility, in this context,

means the correct identification of contracting problems and phenomena, the accurate examination and study of particular phenomena, and the proper reporting and publication of research results. This responsibility includes a commitment to the asking of "why" questions. As stated before, scientific inquiry is the ". . . continual momentum towards self correction which propels scientific interpretation of the world more closely towards the trustworthy and reliable--towards the truth." [25:35] Inquiry is needed and essential, but also associated with this inquiry responsibility is the responsibility of the entire community to constantly review, criticize and/or accept/reject scientific research results. Science is ". . . the activity of an international community of research workers who constantly cross-check their work and criticize each other." [25:35] This constant evaluation and criticism is necessary, for it provides the means of validating new ideas and concepts. It serves, for individuals within the field, as the vehicle for obtaining general consensus and agreement that is necessary for advancing knowledge. The authority of science is, in fact, derived from this social responsibility of critical review and evaluation. [32:33]

The concept of science is also a mindset, one that requires rigorous analysis and testing of hypotheses, diligent search for causal relationships, and constant evaluation of theories as explanations of phenomena. Not

only must people within a science be responsible for the work and action of others within the field, they also must be responsible for their own work and actions. By this, it is meant that science signifies an emphasis on accurate reporting, use of experimentation and manipulation of research data in order to obtain a better understanding of relationships, a focus on the abstract use of generalized explanations that clarify and predict phenomena, and the utilization of elaborate, rigorous methods of conducting research. In short, science implies that individuals will do those things that are the trademark of science. The word "science" in itself does nothing for any field of study. The adherence to the concepts and meaning of science, however, will do much for a field. Through this adherence, the achievements of science, highlighted in Chapter IV, Section C can be obtained. Science, therefore, is more than an honorific title; it is a way of life.

C. SUMMARY

Contracting, as a field of study, appears to be evolving toward a science. This observation is supported by both the Hood-Strayer Model of research progression and the Kuhn Paradigm Building Model of science evolution. The evolution of science, however, will require a change in beliefs, attitudes and actions on the part of the practitioners and researchers within the field. A development of a sense of responsibility for the quality of one's own work and actions

as well as a responsibility for the quality of work and actions of other individuals within the profession is needed. Once this sense of responsibility is obtained by a significant number of members within the field, those actions that typify the trademarks of science can be accomplished. Until this change in personal values is achieved, contracting as a science will not prosper.

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. RESTATEMENT OF OBJECTIVES

This research effort was designed to provide a better understanding of the applicability of the "science" concept to the field of contracting. In short, the study addressed the question of whether or not contracting is a science. The research questions and objectives not only established the scope and direction of the thesis, they also highlighted the major issues of the contracting science discussion that needed to be examined. These issues included the determination of science characteristics and requirements, the identification of contracting characteristics that would conform to the requirements of science, (including the specification of a distinct subject matter and principles of contracting) the examination of problem areas associated with the study of behavioral science, and the determination of how to best establish a contracting science.

The findings of this study have provided tentative answers to these issues.

B. CONCLUSIONS

The increased importance and significance of the contracting method of procurement has placed added emphasis upon the conduct of contracting research. This research is needed to provide insight and understanding into the many

intricacies and peculiarities of the contracting process. Contracting research conducted in the current environment, however, has been flawed in many respects. Difficulties exist in the understanding of the nature of contracting research, in the identification of contracting problems, in the proper evaluation of research results, in the integration of various research efforts, in the maintenance of research objectivity, and in the establishment of a coherent research data base. These problems hamper the effectiveness and reliability of contracting research. Approaching the conduct of contracting research from a science perspective could reduce or eliminate much of the controversy relating to contracting research.

From a review of the literature, it was determined that science is the study of those judgments on which universal agreement can be obtained. This is to say that the goal of science is the achievement of a general consensus on opinions. Science has the following characteristics: the development of laws and theories for explaining and predicting phenomena, the strict adherence to rigorous testing procedures for proving or disproving research hypotheses, and the critical review of research results so as to maintain the credibility of the science. These characteristics serve as the trademarks of science and are the factors that distinguish a science from a field of study.

A field of study must meet certain requirements before being considered a science. These include: the existence of a distinct subject matter, the description and classification of the subject matter, the presumption of underlying uniformities and regularities concerning the subject matter, and the adoption of the scientific method for studying the subject matter. These requirements establish the framework on which all sciences are evaluated.

Many arguments have been raised as to why human-behavioral related fields cannot be classified as sciences. Included as arguments against the science proposition are: the existence of an elusive and complex subject matter, the inapplicability of the scientific method, the inherent confusion surrounding the proper use of language, the belief that human behavioral motivation and control is an art, not a science, and the utilization of contradictory explanations for describing phenomena of a similar nature. Though valid in some respects, their arguments are insufficient in themselves to prevent the classifying of human behavioral fields of study as human behavioral sciences.

Against this background, research was conducted to determine the feasibility of contracting becoming a science. The following specific conclusions apply.

1. The Field of Contracting Encompasses a Distinct Subject Matter

Contracting can be considered as the acquiring of goods and services in the marketplace through the utilization of a contractual instrument. This acquiring process serves as the distinct subject matter which permits focused investigation and examination. Concepts, ideas, theories, and so forth that are considered a part of another discipline can be incorporated into the study of contracting if these concepts, ideas, and so forth have a bearing on the acquiring process.

2. The Subject Matter of Contracting Can be Described

One classification or taxonomy, based on the contracting process, has previously been proposed and discussed. Although this taxonomy may not be the best classification scheme for the contracting subject matter, it does offer evidence that the subject of contracting can be classified. Additional classification schemes may be based on contracting functions, contracting goods or services or contracting customers.

3. The Scientific Method Can be Used in the Conduct of Contracting Research

Although exact procedures for conducting contracting research cannot be specified, the concept of the scientific method concerning speculative thinking, deductive reasoning, and empirical observation has relevance to the study of contracting phenomena. Achieving general agreement regarding

the validity and reliability of research results is the main criterion for judging the effectiveness of the application of the scientific method. That the professional community agrees with the research conclusions indicates approval of the techniques used to obtain the research results. To achieve universal agreement would, by necessity, require adherence to the concept of the scientific method. Because some contracting research can be agreed upon by the contracting community, the conclusion that the scientific method applies to contracting is a valid conclusion.

4. General Principles of Contracting Exist and Can Be Identified

The results of the research conducted for this study revealed that individuals within the contracting field are aware of and familiar with concepts that can be classified as contracting principles. These principles, in this particular case, are not rules of action, which every discipline has, but rather are fundamental truths which are of extreme significance or importance to the contracting profession. More effort is required to fully articulate these principles so that general agreement may be reached. Nevertheless, preliminary work by the researcher indicates that principles exist in the minds of contracting professionals if not in the contracting literature.

5. Underlying Uniformities Exist within the Field of Contracting

That general principles exist and, with more effort, can be fully identified, gives credence to the conclusion that underlying uniformities exist within contracting phenomena. General principles are based on empirical generalities which are, in turn, based on underlying uniformities. To say that general principles exist is to say underlying uniformities exist.

6. The Field of Contracting Meets the Requirements of Science but the Field is not a Science

Just as stating that having all the components of a car does not make a car, meeting all the requirements of science does not make contracting a science. What is required, in both cases, is the assembling of the separate components into a cohesive, and distinct system of beliefs (or object, in the case of the car). People are needed in this transformation process. In contracting, this means that contracting professionals: practitioners, researchers, and professors, must change their attitudes and beliefs concerning the nature of the profession. A sense of responsibility for protecting the credibility of the contracting discipline must be shared by the professional people within the community. A responsibility for questioning contracting unknowns, for rigorously analyzing and testing ideas, and for scrupulously reviewing all

research work is needed both to advance the knowledge of the field and to safeguard the reputation of the profession.

7. Contracting is Evolving into a Science

A review of the history of contracting, however, indicates that this evolution is occurring. The increased importance and significance of the contract has placed greater visibility and emphasis upon the field. The increased visibility and emphasis has generated greater interest in the field and greater concern over the quality of performance. Individuals are becoming more interested in uncovering the answers to tough questions. They are also just as concerned about the manner in which these answers are discovered and disseminated. As more answers are made known, as more explanations become accepted, and as more people accept the responsibility for protecting the reputation of the profession, contracting will become a science. This process can be faster or slower, depending on the commitment of the people within the contracting field.

C. RECOMMENDATIONS

Further work and effort is needed for improving the understanding of the contracting field. The results and conclusions of this study propose a new framework for viewing contracting research and practices. In addition, this thesis suggests starting points for further research and study. The following six recommendations are offered as areas requiring additional examination and study. Although

some of these recommendations are similar to the recommendations offered by Heuer, Kingston and Williams in their 1977 thesis, the importance and significance of those recommendations have not diminished with time. Some of them bear repeating.

1. Additional Research Should be Conducted to More Fully Identify and Enumerate Principles of Contracting

Since principles are considered fundamental truths that are essential to a discipline, it is critical that these principles be identified and expressed as such. A greater understanding and appreciation of the basic principles of contracting will contribute significantly to a better understanding of all contracting phenomena. Principles exist, but they require additional work in fully identifying them.

2. The Procurement Research Taxonomy, Proposed in the 1977 Thesis, Requires Closer Examination and Evaluation

A classification of subject matter is helpful in the development of theories and hypotheses. Valid theories, explaining and predicting phenomena, are needed for advancing the knowledge of the contracting field. Although the Procurement Research Taxonomy also classifies the contracting subject matter, the classification may not be the best or most appropriate scheme for developing theories. The taxonomy, because it is process-oriented, channels contracting thinking into a process-oriented direction.

Perhaps it would be more beneficial to look at contracting subject matter from a different view or perspective. A classification scheme that contributes more to the explanation process might be developed if adequate research is conducted in this area.

3. The Definition of Contracting Science, Proposed in This Thesis, Should be Critically Analyzed and Evaluated

Specifying the boundaries or limits of a contracting science is an essential first step in the evolution of a contracting science. By defining the subject matter, research efforts become more focused and more concentrated. Greater insight is gained on specific relationships underlying the subject matter. The definition of a contracting science, offered through this study, attempts to narrow the focus of contracting research: critical evaluation is required to validate this definition.

4. More Research Effort Should be Devoted to the Development of Contracting Theories

Theories are developed to explain and predict phenomena, not just describe the phenomena. Too often, contracting research is focused on the "how" of a particular problem and not the "why" of the problem. Cause and effect relationships need to be examined and theories explaining these relationships need to be proposed.

The offering of possible theories of contracting phenomena will go a long way in advancing the knowledge of the discipline. Rigorous, empirical testing is still

required, but the development of theories is a crucial beginning of the testing process.

5. Research Studies, with Longer-range Focus, Should be Sponsored and Conducted by Both DOD and Non-DOD Organizations

Research today is conducted in a short-term, reactive environment. This type of environment is not especially conducive to the development of contracting theories, yet this characteristic of science is needed to improve the understanding of contracting phenomena and to expand the frontiers of contracting knowledge. By applying a longer term focus, problems can be evaluated on a long term basis. More detailed, in-depth analysis can be performed, and a better understanding of cause and effect relationships can be obtained. Once the time restraint is removed, conditions become more favorable for developing and testing new and novel approaches to contracting problems. More pure research is needed.

6. Contracting Research Needs to be Published and Shared within the Contracting Community

The full dissemination of contracting research permits the close scrutiny and examination that is needed for the validation of research results. Intellectual discussion of new ideas or approaches is necessary for verifying the content of the research and for achieving the universal agreement that is so necessary for a science. In this respect, the contracting profession needs to establish a scientific journal, dedicated to the publishing and

discussion of new research results. Although contracting magazines and periodicals currently exist, these magazines, as currently designed, do not serve as the proper forum for open and honest discussion of contracting research ideas. A different vehicle is required.

D. SUMMARY

This final chapter presented conclusions that were based upon the research conducted by the writer. Recommendations were made with the hope that more can be learned about this subject.

This study is but a small step in the difficult task of bringing order to contracting research and to the field of contracting in general. There are, without a doubt, imperfections in this research; however, the writer hopes further researchers will use this thesis as a guide or stepping-stone for conducting future studies. The field of contracting can only benefit from such studies.

APPENDIX A

LIST OF PEOPLE INTERVIEWED

Arvis, Paul., Ph.D., Professor, Florida Institute of Technology (Ret), Fort Lee, Virginia.

Beck, Al, Colonel (Ret), USAF, Instructor, Defense Management Systems College, Fort Belvoir, Virginia

Hood, Joe, Ph.D., Assistant Director, Federal Acquisition Institute (Ret), Washington, D.C.

Judson, Robert, Ph.D., Senior Manager, Contracts and Grants, Rand Corporation, Santa Monica, California

Lamm, David V., DBA, CDR, SC, USN (Ret), Adjunct Professor, Naval Postgraduate School, Monterey, California

Martin, Martin D., Ph.D., Col, USAF (Ret), Associate Professor, School of Business Management, Western Carolina University, Cullowhee, North Carolina

Pursch, William C., Ph.D., LCOL, USA (Ret), Chairman, School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB, Dayton, Ohio

Sherman, Stanley, Ph.D., Professor, School of Government and Business Administration, The George Washington University, Washington, D.C.

Skipp, Robert, LCOL, USAF, Director, Air Force Business Management Research Center, Wright-Patterson AFB, Dayton, Ohio

Wells, Rita L., Professor of Procurement, Air Force Institute of Technology, Wright-Patterson AFB, Dayton, Ohio

Williams, Robert F., Ph.D., Director, Army Procurement Research Office, Fort Lee, Virginia

APPENDIX B

LIST OF INTERVIEW QUESTIONS

1. What is a good definition of contracting? What is the scope, purpose, function of contracting?
2. What are the critical problems currently encountered in contracting research?
3. How is contracting research currently validated for accuracy and effectiveness? How can contracting research be made better?
4. Can contracting be defined as a field of specific knowledge? What is the subject matter of contracting?
5. If a principle is a fundamental truth which explains certain phenomena, what are some of the underlying principles that govern contracting? Are there any principles of contracting?
6. Theory is defined as interrelated concepts, definitions and propositions that present a view of phenomena by specifying relations among variables for the purpose of explaining and predicting phenomena. Does the field of contracting have any theories that might meet this definition? Is there a general theory of contracting? Can there be a general theory of contracting?
7. Does theory have any relevance in the contracting field?
8. Is contracting an art or a science? What is the difference?
9. Can contracting be a science?
10. What would be needed for contracting to become a science?

APPENDIX C

DEFINITIONS

1. Deductive Reasoning: the logical process in which a conclusion drawn from a set of premises contains no more information than the premises taken collectively; reasoning that starts from a general rule accepted as fact and assesses a specific case that seems to fit the rule.
2. Hypothesis: conjectural statement of the relation between two or more variables.
3. Inductive Reasoning: the logical process in which a conclusion is proposed that contains more information than the observation or experience on which it is based; the study of many individual situations in order to develop generalized conclusions.
4. Law: statement of an order or relation of phenomenon which is invariable under the given conditions; an invariable association.
5. Principle: a fundamental truth or assumption considered to be of extreme central importance or significance to a discipline.
6. Science: the study of those judgments concerning which universal agreement can be obtained.
7. Scientific Research: a systematic, careful inquiry or examination to discover new information or relationships and to expand/verify knowledge for some purpose.
8. Social Science (Behavior Science): body of knowledge pertaining to how people behave, the relationship between human behavior and total environment and why people behave as they do.
9. Theory: a systematically related set of statements, including some lawlike generalizations that is empirically testable. The purpose of the theory is to increase scientific understanding through a systematized structure capable of both explaining and predicting phenomena.

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